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EDÉN (J.) & RENNERFELT (E.). **Undersökningar enligt klotsmetoden av några träimpregneringsmedel.** [Investigations on some timber preservatives by the wood-block method.]—*Medd. SkogsforskInst., Stockh.*, xxxv, 10, pp. 1–36, 5 figs., 1 diag., 1947. [German and English summaries.]

The first task of a joint committee appointed by the Swedish State Railways, Telegraphs, and Water Board in collaboration with the Boliden Mining Company in 1941 was a comparative mycological investigation by the German DIN DVM2176 wood-block method [*R.A.M.*, xxv, p. 376] of the relative value as timber preservatives of basilite UA [ibid., xxi, p. 277], Boliden salt (a mixture of arsenic acid plus sodium arsenate, sodium bichromate, and zinc sulphate) [cf. ibid., xv, p. 414], and Boliden fluorine salt. The salts were used in part at the prescribed rates and in other tests at concentrations exceeding and falling below the standard dosage by 25 and 50 per cent., respectively, while the creosote oil was applied in amounts of 75 and 150 kg. per cu. m. sapwood. A number of the treated blocks were leached in running water for a month, while some of those impregnated with creosote were subjected to vacuum-drying before inoculation in Kolle flasks with *Coniophora cerebella* [*C. puteana*], *Lenzites sepiaria*, *Lentinus squamosus* [*L. lepideus*], *Polyporus vaporarius* [*Poria vaporaria*], *Trametes serialis*, and *T.* [*Lenzites*] *trabea*: ibid., xv, p. 761]; all the cultures were of Swedish provenance, with the addition in the cases of *Lentinus lepideus* and *P. vaporaria* of German collections.

At the close of the four-month period covered by the experiments, there was no perceptible damage on the salt-treated, unleached blocks or on those impregnated with creosote, whether subsequently leached or not. Substantial injury, accompanied by a loss of weight ranging from 12 to 22 per cent., developed only in leached blocks treated with basilite UA at the minimum dosage of 3 kg. per cu. m. and inoculated with *C. puteana*. A German isolate of *L. lepideus* attacked leached blocks previously impregnated with basilite UA at the normal and excess concentrations of 6 and 7·5 kg. per cu. m., respectively.

Blocks treated with the minimum quantities of Boliden salt or fluorine salt (8·75 and 2·5 kg. per cu. m., respectively), then leached, sustained slight infection by *P. vaporaria* (German provenance), but at the normal dosages of 17·5 and 5 kg. per cu. m., respectively, both preparations conferred adequate protection. *L. lepideus* was the most destructive of the fungi used in the tests, followed by *P. vaporaria*, the German collections being uniformly more virulent than the Swedish.

MEYER (E. I.). Стимулирующее действие грибов синевы на развитие домовых грибов. [Stimulatory action of staining fungi on the development of house fungi.]—*Bull. Soc. Nat. Moscou*, Sect. biol., N.S., li, 2, pp. 33–45, 2 figs., 7 diags., 1946. [English summary.]

The interrelations of the agents of blue stain in timber, *Alternaria humicola* [*R.A.M.*, xviii, p. 774], *Ceratostomella coerulea*, *C. piceae*, *Discula pinicola* var. *mammosa* [cf. ibid., xvi, p. 574], *Hormonema dematioides* [*Pullularia pullulans*;

ibid., xiv, p. 270; xxi, p. 356], and *Leptographium* [or *Scopularia*] *lundbergii* [ibid., xv, p. 827], and the house fungi, *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, and *Poria vaporaria*, were studied in beer wort-agar cultures and in fresh pine sapwood.

In pure culture on beer wort-agar the growth of *P. vaporaria* was promoted by *A. humicola* and *L. lundbergii*, while the latter, *Ceratostomella coerulea*, *C. piceae*, and *Pullularia pullulans*, acted similarly on *Coniophora puteana*. In the other cases the relations between the blue-staining and the house fungi were antagonistic or indifferent.

In the *in vivo* experiments wood blocks, 2 by 2 by 3 cm., were inoculated with the blue-stain organism and transferred for a period of two months to flasks containing cultures of the house fungi. The growth of all three of the latter was stimulated by *L. lundbergii*, while *Poria vaporaria* and *C. puteana* responded favourably to *Pullularia pullulans*.

Green (D. E.). **Black spot disease of Brassica seed crops.**—*Gdnrs' Chron.*, Ser. 3, cxxii, 3149, pp. 178–180, 1 fig., 1947.

From time to time during the last five years the seed-bearing stalks of various species of *Brassica*, such as cabbage, cauliflower, and kale, examined at the Royal Horticultural Society's Laboratory, Wisley, have been found to bear the circular black patches produced by *Alternaria oleracea* [*R.A.M.*, xxv, p. 244]. The pods may be killed or ruptured prematurely so that much seed is lost, while a good deal is also thought to be infected and weakened by the fungus. The lateral branches and the siliquae and their stalks may also be infected, and in wet weather the disease spreads so rapidly that reductions of up to 75 per cent. of the crop have been reported. The best means of control would probably be a prophylactic application of Bordeaux mixture or colloidal copper, supplemented by a good spreader since the coverage of these crucifer leaves presents considerable difficulty.

Oort (A. J. P.). **Bepaalt het gehalte aan mosterd-olie de resistentie van cruciferen tegen knolvoet?** [Does the mustard-oil content determine the resistance of crucifers to club root?]—*Tijdschr. PlZiekt.*, li, 4, pp. 117–119, 1945.

The most recent studies by Walker and collaborators in the United States [*R.A.M.*, xxiv, p. 260] appear to invalidate the conclusions reached by Rochlin in the U.S.S.R. [ibid., xiii, p. 140] and Heiling in Germany [ibid., xviii, p. 508] as to the favourable influence of a high mustard-oil content on the resistance of crucifers to club root (*Plasmodiophora brassicae*) [see next abstract].

Lackamp (J. W.). **Over den smaak van Stoppelknollen in verband met den weerstand tegen knolvoet.** [On the taste of Turnips in relation to resistance to club root.]—*Tijdschr. PlZiekt.*, liii, 2, pp. 49–54, 4 graphs, 1947. [English summary.]

The ammoniacal silver nitrate test for the determination of the mustard-oil content of turnips proved unreliable in the writer's experiments at the Plant Breeding Institute, Wageningen, and the resultant black coloration, moreover, gave no indication of sharpness of taste. No evidence was afforded by these studies of any correlation between this property, which is associated with a high mustard-oil content, and resistance to club root (*Plasmodiophora brassicae*) [see preceding abstract].

Giddings (N. J.). **Sugar Beet varieties in relation to curly-top virus strains.**—Abs. in *Sugar*, xlii, 4, p. 52, 1947.

In this paper, read at a meeting of the American Society of Sugar Beet Technologists in February, 1946, it is stated that the first studies on the sugar beet curly-top

virus strains were prompted by the variable results obtained from inoculations of the Old Type and S.L. 68 varieties [*R.A.M.*, xxv, p. 285]. Some strains of the virus were soon segregated and Old Type was shown to be equally susceptible to 1 and 3, whereas S.L. 68, while only moderately resistant to strain 1, was practically immune from 3. All the European and earlier American varieties tested were susceptible to both strains, only the later developed breeders' stocks from the Salt Lake City Laboratory, now released and coming into widespread use, being comparable with S.L. 68 in virtual immunity from strain 3. In these varieties extreme resistance to strain 3 is combined with a similar reaction to the destructive strains 5, 6, 8, and 9.

GREMMEN (J.). **Een bladvlekkenziekte bij Bonen veroorzaakt door Isariopsis griseola Sacc.** [A Bean leaf spot disease caused by *Isariopsis griseola* Sacc.].—*Tijdschr. PlZiekt.*, liii, 2, pp. 55–56, 1 fig., 1947. [English summary.]

At the Plant Breeding Institute, Wageningen, in September, 1946, the leaves of Beka brown beans [*Phaseolus vulgaris*] showed quadrangular, dark brown spots which, unlike those of *Colletotrichum lindemuthianum*, were not delimited by the veins. Microscopic examination of the under sides revealed the presence of masses of dark brown coremia, bearing elongated, often slightly curved, hyaline, bi- to quadricellular conidia, 50 to 75 by 7 to 8 μ. The fungus was identified as *Isariopsis griseola* [*R.A.M.*, xxv, p. 97], already reported from Holland by Schoevers in 1920 (*Tijdschr. PlZiekt.*, xxvi, p. 208): it would seem to be of little economic importance.

OGILVIE (L.). **The control of vegetable diseases.**—*Occ. Publ. hort. Educ. Ass.*, 5, pp. 63–67, 1947.

In these notes on vegetable diseases in Great Britain with special reference to their control by the use of clean seed, improved cultural methods, crop hygiene, and the development of resistant varieties [cf. *R.A.M.*, xxiv, p. 215], the author states that new strains of various disease organisms are now becoming adapted to various crops, e.g., the progressive type of *Verticillium* wilt of hops [*V. albo-atrum*: ibid., xxv, pp. 140, 141]. There is also the case of the strain of tomato leaf mould [*Cladosporium fulvum*] that attacks the Vetomold variety [cf. ibid., xxvi, p. 35]. The Roscoff broccoli strains, formerly resistant to *Mycosphaerella brassicicola*, are now susceptible. Strains of *Rhizoctonia* [*Corticium*] *solani* have recently been found on onions, peas, and other vegetable crops. In addition, diseases formerly fairly restricted are now widespread.

In order to secure healthier vegetables it is essential that the seed shall be cleaner than it is at present. Vegetable diseases commonly seed-borne [ibid., xxvi, p. 69] are listed. Also seed-transmitted but less commonly are ring spot of brassicas [*M. brassicicola*], lettuce ring spot [*Marssonina panattoniana*], and, occasionally, onion downy mildew [*Peronospora destructor*] and club root of brassicas [*Plasmodiophora brassicae*]. *Didymella* [*lycopersici*] on tomatoes [ibid., xxv, p. 371] and bean chocolate spot [*Botrytis cinerea*] are also seed-borne.

The 'picking over' process with peas and dwarf beans removes the seeds most heavily infected with fungi, but leaves too many that show no external symptoms. The best method is to grow the plants for seed in very dry areas, where diseases do not flourish [see below, p. 373]. Hickman, for example, working at Long Ashton found that of 29 samples of pea seeds grown in England 26 were infected, of which eight showed 20 per cent. or more infection, whereas only nine of 31 samples from Hungary, Morocco, and New Zealand were infected, only two of which showed over 5 per cent. disease.

A careful watch should be kept over nurseries where vegetable seed-stocks are grown. There have been several instances recently in the West of England of

diseases being distributed far and wide through such agencies. Long rotations, isolation of seed crops, suitability of locality, and the like are important.

Spraying is a practicable measure against some of the diseases [ibid., xxiii, p. 462]. Roguing of marrows with mosaic [cucumber mosaic virus] would save considerable losses among tomatoes, spinach, and celery and early roguing of greenhouse tomatoes is essential to keep down mosaic and streak [tobacco mosaic virus], *D. lycopersici*, *Verticillium* [*albo-atrum*], and *V.* [*dahliae*]. The policy of the Somerset War Agricultural Committee requiring the destruction of diseased Calla lilies [*Zantedeschia* sp.] has practically eliminated [tomato] spotted wilt from the local glasshouses.

D'Oliveira (Maria de L.). **O 'mosaico' de Faveira e suas relações com outras Leguminosas.** [The Broad Bean mosaic and its relations with other Leguminosae.]—*Brotéria*, xv, 2, pp. 90–94, 1946.

Ten minutes' exposure to temperatures of 50°, 60°, and 70° C. did not impair the pathogenicity of a strain of the mosaic virus isolated from broad beans [cf. *R.A.M.*, xviii, p. 224] at Tapida da Ajuda, Portugal, in 1937 and since maintained in culture; after the same period at 80° only half the inoculated plants contracted infection, while a temperature of 90° was lethal to the virus. The pathogenicity of the virus underwent no diminution on dilution with distilled water in proportions of 1 in 500 to 1 in 3,000. Only half the plants inoculated with the juice from diseased plants in dilutions of 1 in 4,000 reacted positively, and all those in the 1 in 5,000 and 1 in 6,000 series remained healthy. The virus was inactivated by treatment with 60 per cent. alcohol. Positive results were obtained in inoculation experiments on *Vicia faba* var. *minor*, garden and field peas, sweet peas, *Lathyrus latifolius*, and *Cicer arietinum*.

Löhnis (M[arie] P.). **Een voedingsziekte in Bonen (Phaseolus). Voorloopige mededeeling.** [A nutritional disease in Beans (*Phaseolus*). Preliminary report.] —*Tijdschr. PlZiekt.*, lii, 5–6, pp. 157–160, 1946. [English summary.]

Beans (*Phaseolus vulgaris*) in experimental plots at Wageningen supplied with little or no marl or given an ammonium sulphate amendment suffered each year from 1940 to 1944, inclusive, and again in 1946, from a disease characterized by interveinal chlorosis and later spotting and curling of the leaves, a brownish-purple spotting of the petioles and stems, generalized stunting of the plants, and poor development of the root system. The trouble may assume a severe form following wet weather, sometimes involving failure of the entire crop. The marl deficiency symptoms were further observed on sandy soil in the surrounding country, the foliage of the particularly susceptible dwarf French beans turning whitish-yellow and the plants remaining abnormally small.

There is some evidence that manganese toxicity may be the cause of the injury [cf. *R.A.M.*, xxii, p. 339]. The manganese content of diseased leaves was found greatly to exceed that of healthy ones. Plants grown in jars containing 300 gm. soil from affected plots develop the symptoms at an early stage unless forestalled by the addition of calcium carbonate (0·6 gm.), the beneficial effect of which is counteracted by a subsequent admixture of manganese sulphate (0·75 gm.).

Wilson (R. D.). **Rainfall in relation to the production of Bean seed free of the bacterial blight diseases.**—*Agric. Gaz. N.S.W.*, lviii, 1, pp. 15–20, 1 fig., 1947.

The most important seed-borne diseases of beans in New South Wales are halo blight (*Pseudomonas medicaginis* var. *phaseolicola*) [*R.A.M.*, xxiv, p. 172 and next abstract], which affects most varieties of dwarf French beans [*Phaseolus vulgaris*], and American common blight (*Xanthomonas phaseoli*) [ibid., xxv, p. 22] on Navy beans [*P. vulgaris*]. Mackie, Snyder, and Smith (*Bull. Calif. Agric. Exp. Sta.* 689,

1945) suggested that disease-free seed could be produced in areas having less than 1 in. rainfall in the growing season but there are no areas in New South Wales where the summer rainfall is low enough. Thus, consistent production of blight-free seed of susceptible varieties is not possible unless clean seed is used for the seed crop or thorough roguing is practised. Unless irrigation is adopted, a rainfall of about 10 in. during the four summer months is required in most parts of the State for the commercially profitable production of bean seed. The detection of trace infection of the bacterial blights and anthracnose (*Colletotrichum lindemuthianum*) [loc. cit.] is easier in high- than in low-rainfall areas, and the seed certification scheme [loc. cit.] introduced into New South Wales some years ago is easier to carry out in areas of high summer rainfall such as the south coast than it is elsewhere. The problem of obtaining clean seed of susceptible varieties is more likely to be solved in New South Wales by a certification scheme with zero tolerance for these three diseases than by any reliance on dry conditions to prevent spread.

Wilson (R. D.). **Soil carry-over of the Bean halo blight disease.**—*J. Aust. Inst. agric. Sci.*, xii, 3, pp. 103–107, 1946.

During field observations on the soil carry-over of the halo-blight organism *Pseudomonas medicaginis* var. *phaseolicola* [*R.A.M.*, xv, p. 765; xxvi, p. 41] a diseased bean crop (*Phaseolus vulgaris*) was ploughed in and the area replanted a week later with seed of the resistant Hawkesbury Wonder. The crop was slightly infected as it developed, but as all other crops from the same batch of seed remained healthy it is concluded that infection came from the ploughed-in material. The halo-blight organism was found to be viable in dry, sterile soil after 11 months under laboratory conditions.

The infective capacity of cultures of the halo-blight organism in beef extract-peptone broth was markedly reduced by the addition of a mixed culture from soil or bean seed infusion containing saprophytic organisms. Where broth cultures of the organism were added to autoclaved, dry soil which was then sown with disease-free seed of the susceptible variety Tweed Wonder, infection occurred in plants from sowings up to 125 days after adding the inoculum. No infection occurred when 68 days passed between the addition of the inoculum and the seed-sowing where the soil was watered twice a week until sown. When cut-up infected plants were incorporated in their own soil, infection occurred in the next crop from seed sown 22, 41, and 52 days after the inoculum was added but not when 64 days, 5 months, and from 5 to 18 months elapsed between the inoculation and seed sowing. The soil, therefore, is an unlikely source of the carry-over of the disease from one growing season to the next.

Bohn (G. W.) & Maloit (J. C.). **The effects of carborundum in inoculating Bean plants with bacteria.**—*Phytopathology*, xxxvii, 3, pp. 196–198, 1 fig., 1947.

To investigate the action of 300-mesh carborundum in the inoculation of Black Valentine kidney beans (*Phaseolus vulgaris*) with *Pseudomonas* [*medicaginis* var.] *phaseolicola* and *Xanthomonas phaseoli*, both of which enter the leaves of this susceptible variety through the stomata, fully expanded primary leaves and first trifoliate leaflets were dusted with carborundum before rubbing with a pad soaked in a suspension of either organism. In another series the carborundum was omitted and the control plants were dusted and rubbed with a water-soaked pad. In the inoculations with *P.m.* var. *phaseolicola* one out of 30 dusted leaves and three out of 45 non-dusted ones were free from infection, the spots being considerably more numerous on the former. Two out of five leaves inoculated with *X. phaseoli* but not dusted escaped infection, while all the dusted ones developed acute symptoms. The water controls remained healthy.

The results of these experiments and those previously reported with bacterial spot of currant (*P. ribicola*) [*R.A.M.*, xxv, p. 349] indicate the utility of carborundum in tests with wound parasites and on hosts with hard, glabrous, thickly cutinized foliage.

Yu (T. F.). **Spotted wilt of Broad Bean.**—*Phytopathology*, xxxvii, 3, pp. 191–192, 1947.

Broad beans in the Chengtu district of Szechuan, China, sustained heavy damage in the winter of 1937 from a disease with the characteristic symptoms of the tomato spotted wilt virus, including a pronounced necrosis of the tops. The virus was collected from diseased beans and transmitted to young greenhouse tomato plants, extracts from which were rubbed on bean seedlings. Typical streak developed on a fair proportion of the plants, while young seedlings died within a fortnight of inoculation. On older plants the first symptoms consisted of spots about 1 mm. in diameter, rapidly expanding into oval or oblong lesions, 1 to 1·5 cm. long, with diffuse margins, later becoming zonate and darkening to black. The leaves curled slightly downwards or inwards along the tip or margin, finally shrivelling and collapsing, with the resultant top necrosis observed in the field. Infection subsequently spread to the lower leaves and killed the plants. Purplish-red, gradually blackening streaks of variable length were formed along the stems, which withered and dried. Infection of field plants after pod formation generally led to shrinkage and discoloration of the seeds, the coats of which bore black, necrotic spots. Normal seedlings were seldom produced.

The virus was readily transmitted by juice inoculations to tomato, tobacco, chilli, and *Zinnia elegans*, inducing the familiar bronzing of the foliage in the first-named. Its properties agree with those of the tomato spotted wilt virus, which was probably conveyed to the broad beans from neighbouring tomato fields through the agency of an insect vector.

Yu (T. F.). **Cercospora leaf spot of Broad Bean in China.**—*Phytopathology*, xxxvii, 3, pp. 174–179, 2 figs., 1947.

A leaf spot of broad beans due to *Cercospora fabae* [*R.A.M.*, xii, p. 263] is very prevalent in south-eastern China, but causes heavy damage in wet seasons only on the lower-lying rice land where bean-rice rotations are practised. Under such conditions the lower leaves decay and fall in the early spring, thereby arresting the normal development of the plant. The zonate lesions, mostly on the foliage, are oblong, circular, or irregular, averaging 5 to 7 mm. in diameter, with grey centres and chocolate to red raised margins. The diseased tissues may drop out, leaving shot holes. The occasional spots on the leaf petiole and stem are fusiform or oblong, with grey centres and deep red edges, almost indistinguishable from those produced by *Ascochyta fabae*. During wet seasons black lesions may often be found on these organs.

Greenhouse inoculations with conidial suspensions caused typical spots to appear on unwounded broad bean leaves but gave negative results on 14 other species and one variety of leguminous plants tested.

Overwintering is effected by means of conidiophores or stromatic mycelium on the dead leaves.

Yu (T. F.). **Ascochyta blight and leaf and pod spot of Broad Bean in China.**—*Phytopathology*, xxxvii, 4, pp. 207–214, 3 figs., 1947.

The species of *Ascochyta* causing heavy damage to the broad bean crop in Nanking, China, is in substantial symptomatological and morphological agreement with Sprague's and Rothschlag's descriptions of *A. pisi* on the same host in the United States and Germany, respectively [*R.A.M.*, ix, p. 273; x, p. 284]. The fungus was

shown by inoculation experiments to be unable to infect peas and other legumes, including *Vicia* spp., and from its strict specialization on broad bean would seem to be a distinct variety for which the name *A. pisi* var. *fabae* Sprague is proposed. The pycnidia, which occur at the centre or in circular zones on the spot, are globose-depressed, light brown, 95 to 270 by 111 to 301 μ in diameter with oblong, straight, or sometimes curved uni- or rarely bi- or tri-septate, 1·4 to 30·4 by 3·8 to 7·9 μ.

In 1934, diseased plants yielded less than half the normal crop in many parts of Kiangsu; for the next three years infection was prevalent but mostly slight along the Yangtze river. In 1940 a virulent outbreak occurred on higher ground near Chenkiang, Yunnan, causing losses of 80 to 100 per cent. of the stand. The fungus was shown experimentally to overwinter on dead stems and pods and also in the form of dormant mycelium in the seed coat, producing pycnidia when the seed begins to germinate in the spring.

Heringa-Westerhof (A. C.). **Het vruchtvuur in de Komkommers veroorzaakt door Cladosporium cucumerinum Ellis et Arthur en zijn bestrijding.** [Cucumber gummosis caused by *Cladosporium cucumerinum* Ellis & Arthur and its control.]—*Tijdschr. PlZiekt.*, lii, 5–6, pp. 138–149, 2 diags., 1946. [English summary.]

Cucumber gummosis (*Cladosporium cucumerinum*) may be responsible for substantial damage in Holland [*R.A.M.*, xi, p. 690], where steps are seldom taken to combat the disease. No confirmation has yet been obtained of the opinion current among gardeners that wet weather favours the development of the fungus.

In the author's experiments in 1945 the pathogen grew best on sterilized potato slices. Inoculations on mature fruits (20 cm. or more in length) and the basal region of young ones (12 cm.) were invariably unsuccessful, the entry of the fungus being probably barred by the suberization of the outer and side walls of the epidermal cells.

With regard to control [ibid., xii, p. 485], *in vitro* tests showed the growth of *C. cucumerinum* on cucumber agar to be inhibited by shirlan at 0·0048 per cent., mercuric chloride (0·008), aretan (0·012), bulbosan (0·04) [ibid., xxii, p. 281], and an unnamed preparation (1) at 0·016 per cent. When the plants in 12 frames were dusted on 29th August, 1st, 6th, 17th, 22nd, and 27th September, and 4th October with bulbosan at dosages of 21, 10, 21, 10, 16, 12·5, and 9 gm. per frame, respectively, 49 out of 55 fruits were healthy and six slightly infected on 6th October. While bulbosan prevented the development of new infections, thereby ensuring a satisfactory late-season crop, it proved ineffectual against the extension of those already established before its application. Bulbosan (0·44, 0·125, and 0·444 per cent.) and mercuric chloride (0·25 and 0·125 per cent.) also gave promising results in soil-disinfection trials and might be of practical use in this capacity.

Treschow (C.). **Champignondyrkning i Haver.** [Mushroom cultivation in gardens.] —*Friesia*, iii, 3, pp. 189–196, 2 figs., 1946. [English summary.]

Mushrooms can be grown out of doors in Denmark from June to November. The beds should be situated in the shade with some hours of morning and evening sunshine only. The cold frames used for cultivation should be 90 cm. in width, the wooden board on one side being 30 cm. in height and on the other 20 cm., a covering of asphalt paper on a wooden framework should be provided, and the frames must stand on firm ground, surrounded by a trench to drain off the rain. The horse manure used for composting should be procured about the middle of May. The process is completed in some 20 days. Two or three days after the compost has been placed in the frames, small pieces of mycelium are introduced into the layer in rows 25 cm. apart at intervals of 25 cm. The frame is then covered and the culture left untouched for about a month. When the whole mass, 10 cm. below the

surface, is interwoven with fine, white hyphae, the surface is copiously watered and the next day covered with a loose layer, 2 cm. thick, of loamy subsoil. The first mushrooms should appear after a fortnight or so and a yield of 10 kg. per sq. m. bed surface may be anticipated.

Infection by the destructive pathogen *Mycogone perniciosa* [*R.A.M.*, xxv, pp. 58, 94] may be avoided by the cultivation of *Psalliota bispora* var. *avellanea* or spraying with Bordeaux mixture 1–1–50 at the rate of 1 l. per sq. m.

SARASOLA (A. A.). **Enfermedades del Girasol.** [Sunflower diseases.]—[*Publ.*] *Dir. Agric., B. Aires*, 14 pp., 3 figs., 1942. [Received May, 1947.]

This pamphlet summarizes in popular terms the available information on the three principal diseases of the sunflower in Argentina, where the crop is stated to have acquired great importance of late years as a source of culinary oil: stem rot (*Sclerotinia sclerotiorum*), white rust (*Cystopus tragopogonis*) [*R.A.M.*, xxiii, p. 423], and powdery mildew (*Erysiphe cichoracearum*). Soriano has recorded the presence on sunflower of a virus of the mosaic type [ibid., xiii, p. 317]. *Sclerotium rolfsii* has been observed on the crop in Santa Fe, and Carrera has isolated *Fusarium javanicum* [ibid., xxvi, p. 207] from the collar region of the same host.

HADORN (C.). **Lässt sich eine Rotbrenner-Epidemie wirksam bekämpfen? Ergebnisse aus 4 Jahren Beobachtungen und Erfahrungen.** [Can a 'rotbrenner' epidemic be effectively controlled? Results of four years' observations and experiences.]—*Schweiz. Z. Obst- u. Weinbau*, lvi, 7, pp. 133–152, 3 diags., 5 graphs, 1947.

The writer's observations on the vine 'rotbrenner' (*Pseudopeziza tracheiphila*) epidemic in the canton of Grisons in 1943 have already been reported [*R.A.M.*, xxiii, p. 208]. The present contribution deals at length with further experiments on its control in the three succeeding years. The results of the 1944 trials confirmed previous experience as to the difficulties of effective control, even with the best fungicides available. The following year brought no solution of the problem, but the decisive importance of early (beginning mid-May), highly concentrated, and frequent sprays (at maximum intervals of a week) was again demonstrated. Copper-sandoz (0·5 per cent.) plus thiovit (1 per cent.), representing a combination of copper and sulphur in a particular form, gave very promising results in small-scale tests under controlled conditions.

The foliar discolorations induced by copper-sandoz alone in certain localities did not develop in the presence of thiovit, which is also effective against *Oidium* [*Uncinula necator*].

The following provisional recommendations for 'rotbrenner' control are made on the basis of observations made during recent years, notably in connexion with the 1946 trials. The physical and chemical properties of the soil should be improved by thorough tillage and manuring. The risk of infection starts with the first heavy showers in May and is renewed with every rainy spell until the second half of June. During this critical period the vines should be treated (1) when the first leaves attain a width of about 4 cm., before which, according to Müller-Thurgau (*Zbl. Bakt.*, Abt. 2, x, 1903; xxxviii, 1913), no infection is possible; (2) five to eight days later to coincide with the first anti-*Peronospora* [*Plasmopara viticola*] treatment; (3) after a further five to eight days, in any case before the blossom; (4) immediately after the blossom, paying special attention to the thorough wetting of the first buds; (5) further applications according to the local downy mildew schedule. For large-scale, practical tests in regions where the disease is rife the schedule planned for 1947 consisted in the main of 0·4 per cent. copper-sandoz plus 1 per cent. thiovit for all pre-blossom sprays; 0·4 per cent. copper-sandoz plus 0·75 per cent. thiovit

just after the blossom; and 0·4 copper-sandoz for further treatments. Pending the results of these trials, growers should continue to use 1·5 to 2 per cent. Bordeaux or 0·5 per cent. copper-sandoz at the times prescribed above [cf. *R.A.M.*, xxvi, pp. 185, 228].

HOUSTON (B. R.), ESAU (KATHERINE), & HEWITT (W. B.). **The mode of vector feeding and the tissues involved in the transmission of Pierce's disease virus in Grape and Alfalfa.**—*Phytopathology*, xxxvii, 4, pp. 247–254, 2 figs., 1947.

At the Experiment Station, University of California, Davis, feeding punctures of the following insects concerned in the transmission of the Pierce's disease virus in vine and lucerne [*R.A.M.*, xxvi, p. 42] were examined: adults of *Draeculacephala minerva*, *Helochara* sp., *Neokolla circellata*, and *Carneocephala fulgida*, and nymphs of *D. minerva* and *N. circellata*. All these insects were found to be seeking the xylem tissue in the course of feeding. In a representative batch of material comprising vine stems and leaves and California Common lucerne, 88·2 per cent. of a total of 110 punctures by *D. minerva* ended in the xylem, 2·7 per cent. reached the phloem, and 9·1 per cent. failed to traverse the parenchyma. Penetration of the mouth parts to reach the xylem appeared to be effected haphazard through the phloem or medullary ray, the passage being made either between or through the cells, including the tracheal elements. The presence or absence of the virus either in the vectors or in the host did not influence their mode of feeding. The feeding of viruliferous vectors on different parts of vine and lucerne stems showed that the virus could multiply and cause the disease only when the xylem tissue could be reached by the vector in the course of feeding. The rapid upward movement of the virus in lucerne stems suggests the possibility of its migration through the tracheal elements.

GAUDINEAU (MLLE M.) & DE SÈZE (R.). **Essais de lutte contre le mildiou et l'Oidium de la Vigne en 1943.** [Attempts to control Vine mildew and *Oidium* in 1943.]—*Ann. Épiphyt.*, N.S., x, Fasc. unique, pp. 65–78, 4 figs., 1944. [Received February, 1947.]

Second-degree trials with different preparations against vine mildew [*Plasmopara viticola*: *R.A.M.*, xxv, p. 488] carried out in 1943 at La Grande Ferrade led to the following conclusions. Intensity of defoliation was strikingly at variance with the apparent importance of leaf lesions. Spray materials low in copper appeared to keep the leaves free from infection, but did not prevent their premature fall. This was also observed in 1942, when, as in 1943, infection was light; should it occur in a year of heavy infection, a mixed treatment might be justified, in which copper would be used only when considered indispensable.

A product containing 15·3 per cent. copper as copper oxychloride and used at the rate of 100 gm. per hl. conferred good protection and is considered to merit further test, as does a 15 to 16 per cent. organo-zinc compound used at the rate of 1 per cent. The trials confirmed the view that cuprammonia mixtures can protect the foliage sufficiently during moderate outbreaks, but a concentration of 50 gm. copper per hl., double that used in 1942, was inadequate when only the number of spray applications advised by the Plant Protection Service was given, and it was found necessary either to use 100 gm. per hl. or to make a supplementary application. Bordeaux mixture 2 per cent. was superior to more dilute strengths.

Three applications of sublimated sulphur arrested infection by *Oidium* [*Uncinula necator*: ibid., xxv, p. 489, 490, xxvi, p. 4] and two applications of impregnated sulphurs (sulphur plus sodium carbonate or bentonite) kept the vines free. Colloidal sulphurs were also active against the same disease when the dosage was not too weak, but all except one, a suspension containing 50 per cent. sulphur and used at 0·5 kg. per hl., were definitely inferior to powdered sulphur. Abbé Dubaquié's copper polysulphide mixture gave encouraging results in its first year's trial.

CHAMBERLAIN (E. E.). **A list of plant virus diseases in New Zealand.**—*N.Z. J. Sci. Tech.*, A, xxviii, 4, pp. 234–237, 1946.

This is a tabulated list of 31 virus diseases in alphabetical order of their common names, following the usage of the *Review of Applied Mycology*, occurring on 66 hosts under field conditions in New Zealand, with references to the pertinent literature. The names used by K. M. Smith in his 'Text-Book of Plant Viruses' [*R.A.M.*, xvii, p. 52] are given whenever possible. The hosts are separately enumerated also in alphabetical order of their common names.

THUNG (T. H.). **Antagonistische acties van viren. I.** [Antagonistic actions of viruses. I.]—*Tijdschr. PlZiekt.*, liii, 2, pp. 43–48, 1947. [English summary.]

The author's previous studies on the relative predominance of different viruses inoculated into the same plant are summarized [*R.A.M.*, xix, p. 241]. Later investigations have been concerned with the rates of propagation and multiplication of groundnut viruses, a paper on which is stated to be in the press. Since rapidity of multiplication may imply rapidity of propagation (rate of spread in the tissues) and predominance or strength, the question arises whether these properties are mutually dependent or independent, necessitating a comparison between the results of inoculation experiments and the following theoretical possibilities: two viruses are propagated at (*a*) an equal rate (P); (*b*) an unequal rate (p); two viruses are multiplied at (*c*) an equal rate (M); (*d*) an unequal rate (m); two viruses are (*e*) equal in strength (S); (*f*) unequal in strength (s). The following combinations may therefore result from the joint inoculation of two viruses into a single plant: PMS, PMs, Pms, pMS, pMs, pmS, and pms. If they are shown experimentally to be present, it may be assumed that the properties of propagation, multiplication, and strength occur independently.

Annual Report of the Massachusetts Agricultural Experiment Station for the fiscal year ending 30th June, 1946 (Bulletin 436).—70 pp., 1 fig., 1946.

This report [cf. *R.A.M.*, xxv, p. 333] contains the following items of phytopathological interest. In studying the Dutch elm disease problem M. A. MCKENZIE and A. V. OSMUN report that up to 1st July, 1946, *Ceratostomella ulmi* [ibid., xxvi, p. 365] had been isolated from 182 trees in three counties although losses are not yet serious. Observations on the spread of the disease during the past five years show that it develops where conditions favour the carrier beetle [*Scolytus* and *Hylurgopinus rufipes*] population. The spread of the disease may be controlled by checking *C. ulmi* on weed elms and by timely disease control measures. The *Cephalosporium* wilt of elm [*Dothiorella ulmi*: ibid., xx, p. 608] was reported from three additional municipalities.

W. L. DORAN found that, in the absence of fungicides, damping-off is much less severe if soils with a moisture content of about 30 per cent. of the water capacity at the time of seeding are not watered for four or five days afterwards. In tests of organic fungicides used with fertilizers for the control of damping-off, cabbage club root [*Plasmodiophora brassicae*: ibid., xxv, p. 148], and soil-borne onion diseases, the best results were gained with pyridyl mercurichloride or ethyl mercury phosphate in a limed soil. The yield of onions in soil infested with pink rot [*Fusarium vasinfectum* var. *zonatum* f. 1: ibid., xxv, p. 101] was substantially increased by applying thiosan at 70 lb. and fermate at 70 and 50 lb. per acre. Dithane, tuads (tetramethyl thiuramdisulphide), and phygon at 2·5, 0·6, and 0·45 gm. per sq. ft., applied with fertilizer to soil infested with *Pythium* spp., markedly improved stands of onion, cabbage, tomato, and beet. Similarly used, tuads, phygon, and dithane, respectively, improved [chilli] pepper, peas, and cress and dow seed protectant No. 9 at 0·45 gm. per sq. ft. improved cabbage, beet, and cucumber stands. There-

fore the use of fertilizer as a fungicide carrier in the quantities mentioned seems promising. The pre-emergence damping-off of *Lilium regale* seed was best controlled by pre-treatment with thiosan, arasan, or semesan.

W. L. Doran found that rooting of hemlock [*Tsuga canadensis*] cuttings taken in October and November was not improved by arasan after treatment with a root-inducing substance. American holly [*Ilex opaca*] cuttings rooted in larger percentages after treatment with indole-butyric acid alone than if followed by treatment with fermate or spergon. Spergon caused some injury to cuttings of Norway spruce [*Picea abies*] when used as a carrier of the acid and applied as a powder-dip, but fermate and arasan were harmless. Rooting of cuttings of hemlock, American arbor-vitae [*Thuja occidentalis*], and Chinese juniper [*Juniperus chinensis*] was improved by treatment with indole-butyric acid at 4 or 8 mg. per gm. fermate.

E. F. Guba in breeding tomatoes resistant to leaf mould (*Cladosporium fulvum*) [ibid., xxv, p. 334; xxvi, p. 35] released the four resistant types Improved Bay State, Improved Vetomold 121 [ibid., xxvi, p. 8], Leaf Mould Resistant Marglobe, and Leaf Mould Resistant Waltham Forcing for trial in autumn, 1945, of which the Marglobe hybrid is particularly promising. The four plants which derived resistance from No. 129,882 and the varieties Globelle, Vetomold, Vetomold 121, and Bay State are now completely susceptible. It is expected that the varieties now on trial which were developed from No. 112,215 will lose their resistance in time. Crosses between the Italian strain Prince Borghese, *L. peruvianum* [ibid., xxii, p. 502], which is highly resistant to *C. fulvum*, and Pan America strain No. 44 B 292 are being studied.

E. F. Guba found that spraying plots of Hubbard and Butternut squash [*Cucurbita* sp.] with Bordeaux 4–4–50 combined with 1 lb. calcium arsenate practically prevented *Mycosphaerella* [*citrullina*: ibid., xxv, p. 23], *Choanephora* [*cucurbitarum*: ibid., xix, p. 513], and *Alternaria* rots at harvest, the squash thus treated showing very little storage decay. Dipping butternut squash in wax-water-formaldehyde emulsion reduced shrinkage but did not control decay.

Fifty-eighth Annual Report of the Texas Agricultural Experiment Station, 1945.—76 pp., 84 figs., [? 1946. Received April, 1947.]

The following items are of interest in this report [cf. *R.A.M.*, xxv, p. 384]. The variety Sebago [ibid., xxiv, p. 31] has been selected as most resistant to late blight [*Phytophthora infestans*] of potatoes in the Lower Rio Grande Valley.

The follow-up procedure of using sodium hypochlorite at 0·75 per cent. in the final wash before drying, waxing, and packing added to the efficiency of decay control of citrus fruits [ibid., xxv, p. 212; xxvi, p. 148], brightened the fruit, and reduced still further the amount of blue mould [*Penicillium italicum*]. Diphenyl-impregnated tissue fruit wraps [ibid., xxvi, p. 53] also proved beneficial.

Hubam clover [*Melilotus alba* var. *annua*] in two-year rotation with cotton reduced damage from [Texas] root rot [*Phymatotrichum omnivorum*: ibid., xxv, p. 302] and increased yield. Increases in lint yield and decreases in root rot were also recorded when cotton followed a winter cover crop of hubam. The yellow annual clover, *M. indica*, is not so beneficial as hubam in this region.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1945–46*, Part I, pp. 166–202, 15 figs., 1946.

The following items are of phytopathological interest in this report [cf. *R.A.M.*, xxv, p. 543]. I. E. Melhus and C. S. Reddy report that Early Resistant Queen and Black Kleckley melons were increased in 1946 for seed-supply, the latter being very popular as an early variety with resistance to wilt [*Fusarium bulbigenum* var. *niveum*; ibid., xxv, p. 333] and anthracnose [*Colletotrichum lagenarium*].

Watermelon seed was planted at Conesville at 10-day intervals from 16th April, 1946. Very little seedling rot was observed before the beginning of May when there were 2·5 inches of rain and the soil temperature usually ranged from 12 to 15° C. During the first week of May there were several diseased seedlings in the second and third plantings, from most of which *Pythium irregulare* was isolated, and the fourth planting yielded both *P. irregulare* and *F. bulbigenum* var. *niveum*. Isolations after the first week of June were almost entirely of *Fusarium*. In seed-treatment tests with named fungicides [ibid., xxv, p. 24] preliminary results showed arasan to be at least as good as red cuprocide. Arasan, phygon, spergon, and red cuprocide increased the stand of the high and medium germinating seed by approximately 20 per cent. and up to 50 per cent. with poor seed.

H. C. Murphy reports that although there was an excellent oats harvest in 1945 the reduction in yield from disease, the principal causal organisms of which were *Helminthosporium* and *Pythium* spp., amounted to 23·4 per cent. Clinton and some other Bond-hybrid selections were resistant to *H.* [*Pyrenophora*] *avenae* which was very prevalent in the seedling stage. *H. victoriae* [ibid., xxvi, p. 99 and below, p. 389] caused considerable damage but primary seedling infection was effectively controlled by seed treatment with new improved ceresan.

W. J. Hooker, C. S. Reddy, and D. M. Coe, in their propagation of disease-free sweet potato stock, report that in further tests incidence of stem rot [*Fusarium batatatis* and *F. hyperoxysporum*: ibid., xxiv, p. 306] in plants started either as slips or cuttings was about equal at the end of the 1945 season. These data are supported by preliminary results of 1946 tests. Dipping the fleshy roots in semesan bel or dithane before planting resulted in marked increase in slip production.

During tests to examine the influence of pythiaceous and other fungi on seedling stands of various crops led by I. E. Melhus, W. F. Buchholtz, and H. C. Murphy, *Pythium debaryanum* [ibid., xxv, p. 108] and *Fusarium* sp. were equally prevalent on the roots of young oat plants from mid-April to late May, 1945. *P. graminicola* occurred occasionally after 30th April. An attempt is being made to measure the effect of root necrosis on water utilization by cereals. Barley grown in soil infested with *P. graminicola* used only half as much soil moisture as, and had only half the top growth of plants grown in, steamed, uninfested soil. Soil-moisture utilization as measured by top length was similar at high and low soil moisture levels, but on a weight basis it was distinctly low at a low moisture level in infested soil. The maize relationships were similar to those of barley, but for oats the differences between plants in infested and non-infested soil were relatively smaller.

In replicated greenhouse experiments by H. C. Murphy, C. S. Reddy, and I. J. Johnson, two isolates of *P. graminicola* [ibid., xx, p. 525], one of which was twice as virulent as the other, were used to inoculate 104 barley varieties and selections. Some of these were significantly less susceptible than others on the basis of average root length expressed as a percentage of non-infested checks. Wisconsin 38, Glabron, Velvon 8, Tregal, and Manchuria C.I. 4924 were among the most susceptible of the named varieties while Peatland, Pillsbury, Fond-du-Lac selections, and Purdue 21 winter barley were among the less susceptible. A bulked population of Wisconsin 38 obtained through field selection during the poor barley season of 1943 seemed significantly less susceptible to *P. graminicola* and higher yielding than non-selected seed increased from the 1942 crop. The chief drawbacks to successful barley production in Iowa are likely to be *Pythium*, *Helminthosporium*, and *Gibberella* diseases. Moderate resistance to the two last-named is shown by Manchuria and Chevron, respectively.

The antagonism of some species of Actinomycetes in relation to soil-inhabiting fungi was studied by C. H. Meredith and G. Semeniuk. Of those isolated from Iowa soils 21 per cent. were antagonistic towards *P. graminicola* [ibid., xxv, p. 339; cf. xxvi, p. 216]. *Streptomyces* culture no. 211 was most promising for study

in connexion with this disease organism and work was therefore confined to this strain. It was grown on 1 per cent. maizemeal steep and after two weeks maize plants grown with *P. graminicola* in soil treated with the crude solution were taller and had longer roots than those in untreated soil. Plants grown without *P. graminicola* were improved by the addition of the crude solution. Maize grown for two weeks in soil treated with a solution inactivated by heating above 100° grew less than that treated with water or the crude solution. As spores of *Streptomyces* 211 did not control *P. graminicola* the crude and inactivated crude solutions were tested on Carrington, Marshall, and Grundy soils, two weeks later soil samples being added to agar plates. The mean growth measurements of fungi appearing naturally on the plates were: (*a*) crude solution 1·75 cm., (*b*) water 2·19 cm., and (*c*) inactivated crude solution 2·23 cm. On the same media *P. graminicola* grew well in the absence of crude solution but showed no growth in its presence. In comparison with the effects of certain fungicides and antibiotics the active principle was found to be less toxic to *P. graminicola* than mercuric chloride but as toxic as copper sulphate; a concentration of 1 per cent. of the crude solution in the medium or 1 part of its dried residue in 100,000 parts of medium inhibited growth.

In experiments on the control of potato scab [*Actinomyces scabies*] in highly calcareous peat and muck soils [ibid., xxvi, p. 77] in north Iowa by W. J. Hooker, W. F. Buchholtz, and A. T. Erwin, Cobbler and Sebago seed was planted from 27th April to 3rd July at roughly two-week intervals. With both varieties scab incidence was progressively reduced as planting was delayed. During greenhouse inoculation tests varieties resistant to tuber scab were also resistant to stem necrosis caused by *A. scabies*. Present host range studies indicate that under certain conditions many plants not hitherto known to be hosts of the pathogen may be attacked. Of several plants used in tests, growth was markedly reduced only by parasitic strains of *A. scabies*. The same four parasitic and six non-parasitic cultures previously used were tested in the laboratory for their ability to parasitize potato stems. There was a positive correlation between the ability of a culture to reduce seedling root growth, to cause stem necrosis, and produce scab on tubers.

A study of the causal relationship and control of the oak wilt fungus (*Chalara quercina*) was made by S. M. Deitz. Epiphytotics appearing all over the State were most severe in north-eastern Iowa, particularly on red [*Quercus borealis*], black [*Q. velutina*], white [*Q. alba*], Hill's [*Q. ellipsoidalis*], and burr [*Q. macrocarpa*] oaks. Infection of red oaks under field conditions progressed from the top of the tree downwards. Spread usually took place from one dominant tree as the initial point of infection to other dominant and subdominant trees in concentric zones. The rate of spread within red oaks was much faster than in white and burr oaks. The wilt symptoms [ibid., xxiv, p. 80] spread much more rapidly in red oak than did the organism. The field symptoms varied with the species, the season of infection, and stage of maturity of the host. Symptoms varied under field and greenhouse conditions. The following were shown by inoculation to be susceptible; *Q. bicolor*, *Q. montana*, *Q. muehlenbergii*, *Q. rubra*, *Q. rubra* var. *pagodaefolia*, and *Q. shumardii*. *C. quercina* commonly overwinters on burr and white oak and occasionally on red oak, especially when infection takes place in late September or October.

A. W. Welch superintended a study on pod and stem blight of soy-beans caused by *Diaporthe sojae* [ibid., xxv, p. 332] of which the ascigerous stage has been reported only in culture. It occurred naturally on old stems which had wintered in the field. Stems collected during March and stored in moist chambers produced mature perithecia in 17 days. The immersed perithecia had long, tapering beaks, 347 to 521 by 94·8 to 158 μ. The sessile, elongate, clavate asci contained eight bicellular ascospores, each 10·4 to 18·5 by 3·5 to 5·5 μ. The ascospores germinated in two to five hours in tap-water. The best medium for pycnidial formation was sterilized

soy-bean seed coats in a moist chamber, on which pycnidia appeared in abundance in approximately two weeks.

Kulescha (Z.). **Comparaison entre l'action du Phytomonas tumefaciens et celle de l'acide indole-acétique sur les fragments de parenchyme vasculaire de Topinambour cultivés in vitro.** [Comparison between the action of *Phytomonas tumefaciens* and that of indole-acetic acid on fragments of vascular parenchyma of Jerusalem Artichoke cultivated *in vitro*.]—*C.R. Soc. Biol., Paris*, cxli, 5–6, pp. 232–234, 1947.

In further studies on tumour formation by *Phytomonas* [*Bacterium*] *tumefaciens* in vascular fragments of Jerusalem artichoke [*Helianthus tuberosus*] cultivated *in vitro* [*R.A.M.*, xxvi, p. 289], no difference could be detected between the excrescences caused by the organism itself, those developing at a distance from the original focus of infection, and those resulting from the action of indole-acetic acid.

Braun (A. C.). **Thermal studies on the factors responsible for tumor initiation in crown gall.**—*Amer. J. Bot.*, xxxiv, 4, pp. 234–240, 4 figs., 1947.

It was shown by Riker and collaborators, in their comparative studies on the physiology of crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and related organisms [*R.A.M.*, xxi, p. 130], that a profound change in the physiology of either the host, the pathogen, or possibly both, occurs between 28° and 31° C. This observation suggested a useful line of approach to further investigations of the conditions under which the factors responsible for tumour initiation in crown gall become physiologically active in the conversion of normal to tumour cells. The results here reported are concerned with this phase of the crown-gall problem.

A temperature of 32°, just above the critical point for tumour formation in the periwinkle (*Vinca rosea*) [ibid., xxiii, p. 128], prevented the transformation of normal into diseased cells, but exerted no inhibitory effect on the factors inducing multiplication after the consummation of the cellular changes. It was further shown that the failure of the bacteria to effect the cellular conversion did not result from physiological disturbances in the plant as a whole but depended on the environmental conditions prevailing round the site of inoculation. The gross wound-healing response of the plants held at 32° did not differ materially from that of those maintained at 26°, nor did the former temperature exert a demonstrable bacteriostatic action on the organisms in the host tissues. Several possible explanations of these observations are discussed.

The period during which the active principle must be sought has been greatly restricted. The first evidence of cellular alteration was detected after a one- to two-day exposure of the plant tissues to the bacteria, which can only induce this effect, moreover, during the four-day period immediately following injury to the host. The process of conversion of normal into tumour cells being completely arrested by a temperature of 32°, a method is now available for the study of crown-gall inception in the great majority of plants unable to tolerate a high thermal range for sufficiently long periods to kill the pathogen.

Elrod (R. P.) & Braun (A. C.). **Serological studies of the genus Xanthomonas. I. Cross-agglutination relationships. II. Xanthomonas translucens group.**—*J. Bact.*, liii, 5, pp. 509–524, 1947.

Hyperimmune sera were prepared in rabbits for 36 species and subspecies of *Xanthomonas* [*R.A.M.*, xxv, p. 300]. Elimination of the mucoid exudate resulted in cellular antigens which reacted more specifically on cross-agglutination than gummy suspensions. By this means it was possible to demonstrate the existence

of five compact immunological groups, of which three, *vasculorum*, *phaseoli*, and *campestris*, were related through the last-named, while the *translucens* and *pruni* groups were associated to some extent through the antiserum of the latter. Each group manifested a high degree of serological homogeneity.

Comprised in the *X. vasculorum* group, besides *X. vasculorum* itself, are *X. vesicatoria* and its var. *raphani*, *X. hederae*, *X. incanae*, *X. papavericola*, *X. campestris* var. *armoraciae*, and *X. taraxaci*. The *X. campestris* group, consisting of the organism named and *X. barbareae*, reacts reciprocally with all the above-mentioned species. Another group, related to the *campestris* pair but not to the *vasculorum* block, includes *X. phaseoli* and its var. *fuscans*, *X. geranii*, *X. pelargonii*, and *X. malvacearum*. Members of the *X. translucens* group form the largest serological block, which embraces all available species and subspecies of *X. translucens*, *X. maculifolium-gardeniae* [ibid., xxvi, p. 109], *X. cucurbitae*, *X. carotae*, *X. juglandis*, and *X. begoniae*. The *X. pruni* group is composed of the organism named, *X. corylina*, *X. phaseoli* var. *sojense*, and *X. lespedezae*, the heterologous interactions between which are frequently so strong as to equal the homologous titre. The serological affinities of six species, viz., *X. holcicola*, *X. vignicola*, *X. gummisudans*, *X. manihotis*, *X. hyacinthi*, and *X. rubrilineans*, were not sufficiently distinctive to permit of their assignment to any of the differential categories. The systematic position of the three last-named is doubtful.

With the aid of absorbed antisera the numbers of the *X. translucens* group were divided into four serological subgroups. *X. juglandis* and *X. carotae* were each placed in an immunologically distinct subgroup, a third (*cucurbitae*) consisted of *X. cucurbitae*, *X. begoniae*, and four strains of *X. translucens*, one f.sp. *hordei* and three f.sp. *hordei-avenae*, while a fourth (*cerealis*) [ibid., xxv, p. 553] accommodated *X. maculifolium-gardeniae*, one strain of *X. translucens* f.sp. *hordei*, three isolates of f.sp. *undulosa*, and nine of f.sp. *cerealis*. All the organisms comprising the fourth subgroup of *X. translucens* agglutinate in unabsorbed *X. pruni* antiserum.

Reciprocal absorption tests between the organisms in each of the subgroups demonstrated their homogeneity.

Dale (W. T.). **Witches' broom disease investigations. XII. Further studies on the infection of Cacao pods by Marasmius perniciosus Stahel.**—*Trop. Agriculture, Trin.*, xxiii, 12, pp. 217–221, 6 figs., 1946.

This is a further investigation [cf. *R.A.M.*, xxiv, p. 52] into *Marasmius perniciosus* attacking cacao pods in Trinidad [ibid., xxvi, p. 97]. The method of obtaining spores and the inoculation technique previously described [ibid., xxii, p. 242] were used. The seven types of pod infection following inoculation were (*a*) indirectly infected pods on diseased flower cushions having a systemic invasion of the fungus: the ovules do not develop; (*b*) invading mycelium causing hard, carrot-shaped pods and eventual necrosis, beans all small and infected; (*c*) local infections causing asymmetrical pods which become hard and turn dark brown, the beans being completely destroyed; (*d*) larger pods become hard and turn dark brown when ripe but retain their normal shape with a proportion of undamaged beans only in the largest pods; (*e*) necrotic speckling of the inner or outer layers of rind or both, usually in larger fruits only, the beans remaining undamaged if the pods are harvested promptly; (*f*) young infected fruits may succumb to 'cherelle wilt', a physiological disorder [ibid. xxii, p. 293], the fungus areas surviving the remaining tissue for a short while; (*g*) the rind may be rotted by *Colletotrichum* spp., *Botryodiplodia theobromae*, or *Phytophthora palmivora* in addition to *M. perniciosus*. The fruits used in the experiments were Brazilian pods of the Forastero variety Maranhao and those of the Trinidad I.C.S. 1 clonal selection. Large pods were mostly used with smaller ones inoculated for comparison. A decrease in the severity of pod

symptoms was apparent as the size at which the young fruits became infected increased. Multiple infections were the cause of extensive damage after the inoculation of larger pods. The results indicated that the pods of both varieties became more resistant to witches' broom disease as they grew larger, but up to 6·9 cm. there was no sign of changing susceptibility with increasing size and both varieties were equally susceptible to artificial infection. Pods of I.C.S. 1 up to 13·9 cm. and those of Maranhao up to 8·9 cm. were successfully inoculated, some larger pods developing infections confined to the shell. Pods larger than this were apparently immune. The average inoculation periods for pod infection varied from 80 to 90 days, a comparison with healthy controls showing that infection tended to cause premature ripening. This is more marked with the badly diseased pods which had been infected when comparatively small. Where witches' broom is very prevalent in Trinidad there are serious losses from December to March when the pods are picked. The tabulated results indicate that the infections most often begin during the period favourable to sporophore production, September to December. There is a possibility that pods might be protected economically from infection if the position is re-examined. The young pods in particular could be protected easily by the use of a simple sprayer covering a large area in a relatively short space of time, thus reducing mature pod losses.

Posnette (A. F.). **Use of seeds in the insect transmission of some plant viruses.**—*Nature, Lond.*, clix, 4041, pp. 500–501, 1947.

An improved technique for the insect transmission of the viruses causing cacao swollen shoot [*R.A.M.*, xxvi, p. 97] is described. The bean is taken from the ripe pod, the testa removed, and one cotyledon dissected away to expose the convoluted surface of the other. Insects fed on an infected plant are brushed on to the bean placed in a solid or 'block' watch-glass. Humidity can be maintained by means of a square of damp filter paper under the cover of the watch-glass. When the desired feeding time has elapsed, the insects are killed with nicotine solution. The beans are then planted in sterilized sand in an insect-proof house. Germination remains unaffected, and symptoms generally develop in the first or second (occasionally in the third) pair of foliage leaves. The vectors successfully used were *Pseudococcus citri*, *P. njalensis*, and *Ferrisia virgata*.

The method can also be used for testing suspected vectors found in natural outbreaks of virus diseases occurring in localities remote from the laboratory. Peeled cacao beans are planted in damp sterilized sand in specimen tubes of suitable size, the mouth sealed with muslin held by a rubber band. Germination begins immediately and a seedling can be kept in each tube for about a fortnight before transplanting. Suspected vectors are transferred from infected plants to the cotyledons on which they are allowed to feed until a return is made to the laboratory. They are then removed, and the seedling is planted. In this manner, virus transmissions were carried out in swollen shoot areas in the Ivory Coast, the infected plants being established in the Gold Coast after a tour of 1,400 miles lasting 17 days.

Buttress (F. A.) & Dennis (R. W. G.). **The early history of cereal seed treatment in England.**—*Agric. Hist.*, xxi, 2, pp. 93–103, 1947.

In this short, interesting review of the early history of cereal seed treatment in England the authors refer to the work of Olivier de Serres (1600) and to the writings of Francis Bacon (Sylva Sylvarum, 1628), and then show how brining and liming were introduced. Mention is made of other practices advocated by various seventeenth- and eighteenth-century writers, and the paper concludes with a brief discussion of the possible value of these early methods [cf. *R.A.M.*, xxvi, p. 307].

JOHNSON (T.). **Recent changes in the physiologic races of certain of the cereal rusts.** —Abs. in *Proc. Canad. phytopath. Soc., 1946*, 14, pp. 13–14, 1946.

During the last ten years considerable changes have occurred in the physiologic races of certain cereal rusts [in Canada: *R.A.M.*, xxv, p. 387; xxvi, p. 49]. Of wheat stem [black] rust (*Puccinia graminis tritici*), race 56 [ibid., xxv, p. 335] is still predominant. Race 17 [loc. cit.], infrequent before 1940, became common in that year, and remains so. Race 15 B [see below, p. 388] has not been found in Canada; a further spread of this race would have serious consequences, as it is able to attack the Renown, Regent, and Thatcher wheat varieties.

Races of oat black rust (*P. graminis avenae*) [ibid., xxiii, pp. 173, 433; xxiv, p. 356] other than 1, 2, and 5 were seldom found between 1921 and 1942. The problem of breeding for resistance was mainly a matter of developing varieties resistant to these three, and this was done by producing the Anthony and Vanguard oats. Occasionally, race 7 was collected which attacked Anthony, race 8 which attacked Vanguard, and race 6 which infected both. In 1943, race 8 became rather common, and since then it has no longer been possible to regard the Vanguard, Ajax, Vicland, and Talma varieties as resistant [ibid., xxvi, p. 8].

Fifteen races of oat crown rust (*P. coronata avenae*) [ibid., xxiv, pp. 144, 186] have been found in Canada. In eastern Canada, races 2 and 3 were predominant for some years. The resistance of Erban in that area was due to the fact that it shows adult-plant resistance to both; when, as in 1945, race 5 became widely prevalent, Erban reacted as a susceptible variety [ibid., xxvi, p. 8]. The susceptibility of this variety in the prairie provinces is due to the fact that it does not develop adult-plant resistance to races 1 and 4, which are common there.

The reasons for these changes in the distribution of the physiologic races of cereal rusts are discussed, and it is concluded that given a certain degree of distribution, a certain amount of overwintering, and susceptible hosts, then a new strain of rust is likely to become permanently established.

ATKINS (I. M.), HANSING (E. D.), & BEVER (W. M.). **Reaction of varieties and strains of winter Wheat to loose smut.**—*J. Amer. Soc. Agron.*, xxxix, 5, pp. 363–377, 1947.

At one or more of the Kansas and Illinois Agricultural Experiment Stations, and Texas Substation, Denton, 238 varieties and strains of winter wheat have been tested for resistance to loose smut (*Ustilago tritici*) by artificial inoculation in one or more years since 1937 [*R.A.M.*, xxii, p. 294]. Pawnee proved to be the only resistant variety of commercial hard red winter wheat, remaining entirely free from infection in seven years' trials in Texas and showing only a trace in five years in Kansas and 1 per cent. in one year in Illinois, where the most virulent races of the smut were used. Kanred × Hope (C.I. 11976) and Hope × Turkey (C.I. 11964), which are resistant to leaf [brown] and stem [black] rusts (*Puccinia triticina* and *P. graminis*) contracted only slight infection in two seasons in Texas, while a group of unnamed Kawvale–Marquillo × Kawvale–Tenmarq strains were highly resistant in Kansas; many of these react similarly to the rusts and Hessian fly (*Phytophaga destructor*) [ibid., xx, p. 107].

The most uniformly resistant of the 117 soft red winter wheats tested were Currell, Kawvale (semi-hard), Leap, Thorne, and Trumbull, while a number of Mediterranean × Hope strains, including the Austin variety, which are likewise resistant to the rusts, gave very encouraging results in Texas.

All the above-mentioned varieties and selections of both classes of wheat yield valuable parental material for breeding purposes. Differences in varietal reaction at the several stations indicate the presence of a mixture of physiologic races in the inocula and emphasize the need for caution in the transference of infected seed from one area to another to avoid the introduction of new physiologic races into regions hitherto free from them.

Carrera (C. J. M.) & Menase de Giberti (Maria J.). **Pruebas experimentales realizadas con Fusarium graminearum Schw.** [Experimental tests performed with *Fusarium graminearum* Schw.]—*Publ. misc. Minist. Agric., B. Aires*, Ser. A, iii, 25, 7 pp., 1947.

The reactions of the wheat varieties Sinvalocho, 38 M.A., Klein Amalia Klein, Benvenuto, Inca, and La Previsíon to inoculation with 17 isolates of *Fusarium graminearum* [*Gibberella zeae*] from Pergamino and Rafaela, Argentina, are presented in tabular form. The maximum incidence of infection (25 to 100 per cent.) was induced by strain No. 17, isolated from 38 M.A. Rafaela, and the minimum (0 to 40) by No. 8 from Guatraché M.A.

Newton (Margaret) & Cherewick (W. J.). **Erysiphe graminis in Canada.**—*Canad. J. Res.*, Sect. C, xxv, 2, pp. 73–93, 1947.

Wheat, oats, barley, rye, and many grasses in Canada are affected by powdery mildew (*Erysiphe graminis*) [*R.A.M.*, xxiii, p. 291; xxvi, p. 151]. It was recorded every year from 1921 to 1945 with the possible exception of 1924 when no survey was made. In British Columbia, in 1936, the damage from *E. graminis* on the wheat variety Little Club was estimated to be 87 per cent. and on Bond oats 20 per cent. According to reports from Ontario and Quebec, mildew is the most destructive barley disease locally, winter wheat varieties also being badly attacked. Sometimes barley and wheat are badly affected by mildew in certain areas in the Prairie Provinces where oat mildew has not been recorded.

Nine physiologic races of *E.g. hordei* and three of *E.g. tritici* have now been isolated in Canada. In the identification of these races the barley and wheat varieties used were the same as those of Mains *et al.* [ibid., ix, p. 643; xii, p. 362; xvi, p. 376] with the addition of Chevron C.I. 1111. An analytical key is given for the identification of the physiologic races of *E.g. hordei* on the basis of their pathogenicity on six selected differential varieties of barley. Between 1940 and 1945 five new races were identified of which four, 8, 9, 11, and 12, attacked Chevron. These four races, comprising 50 per cent. of the isolates during that period, threaten new barley varieties with resistance of the Chevron type. The prevalent Canadian races are 3, 6, 8, and 9. Races 2, 5, and 7 identified in the United States have not been found in Canada.

Until 1943, only one physiologic race of *E.g. tritici*, attacking the wheat varieties Huron and Chul, had been identified. It was isolated in Manitoba. Three new races identified in Canada and differing from the two described by Mains are tentatively numbered 3, 4, and 5 (Canada). A key for the identification of the five races is given. A study was made of the relative resistance of strains and varieties of barley and wheat to physiologic races of *E. graminis*, the tests being made in the greenhouse. As all the resistant varieties detected by the authors were found to be resistant to mildew in both the seedling and the adult stages, the selection of resistant varieties on the basis of seedling tests should be possible. However, some varieties did not react identically in both stages to powdery mildew, some being more resistant in the adult stage. As higher temperatures tend to increase resistance [ibid., xxiii, p. 292] temperatures were kept down as far as possible during the tests. Tables are given of the infection types [based on a scale ranging from 0 immune to 4 very susceptible] on 246 barley varieties, strains, and species inoculated in the seedling stage with races 1, 3, 4, 6, 8, 9, 10, 11, and 12 of *E.g. hordei* and on 124 wheat varieties, strains, and species inoculated in the same stage with races 4 and 5 of *E.g. tritici*. It was found that some varieties of both cereals are highly resistant to all known Canadian races. Of *Hordeum vulgare* 44 varieties, including 16 Duplex hybrids, are immune or highly resistant to the Canadian races of barley mildew. Of *H. distichon* and *H. deficiens*, respectively, nine and three varieties

possess the same high resistance to all the races. Of the *Triticum vulgare* wheats tested, Chul (R.L. 543), Hope (R.L. 209), H–44–24 (R.L. 229), and most varieties and strains derived from crosses having Hope or H–44–24 as one parent, showed very high resistance to the two races employed in these tests. Only one variety of *T. durum*, Belaturka (R.L. 1443), showed high resistance to both races in the seedling stage, but Gaza (R.L. 1664), Mindum (R.L. 568), and Pentad (R.L. 203), although susceptible in the seedling stage, developed resistance in the adult stage. The tested varieties of *T. dicoccum*, *T. monococcum*, and *T. timopheevi* [ibid., xix, p. 206] all proved resistant to both races in the seedling stage. All hybrids of the highly resistant parent, Duplex (C.A.N. 1129), proved very resistant to all the known Canadian races of *E.g. hordei*; Pasknon (C.A.N. 34) [ibid., xxiv, p. 224] and Minsturdy (C.A.N. 732) are also reported resistant to the United States races. The three recently developed hard spring wheat varieties, Coronation (R.L. 729), Regent (R.L. 975), and Redman (R.L. 1884), are resistant to the Canadian races of *E.g. tritici* known at present.

Detroux (L.). **Recherches sur le piétin-verse (Cercosporella herpotrichoides Fron).** [Researches on foot rot and lodging (*Cercosporella herpotrichoides* Fron).]—*Parasitica*, ii, 1, pp. 1–13, 1 pl., 1946.

After stating that Belgian farmers suffer heavy loss as a result of foot rot and lodging of wheat caused by *Cercosporella herpotrichoides* [*R.A.M.*, xxv, pp. 301, 444; xxvi, p. 50], and pointing out that the best method of control probably lies in developing resistant varieties, the author describes a series of experiments to determine the conditions favouring maximum infection.

In the first experiment, Professor Delos wheat was grown in water-tight zinc pots in a container into which a stream of cold water at about 14° C. was directed, pieces of infected wheat stalks being placed on the seeds when sown. No difference in the degree of infection was observed between the experimental plants and controls grown at 20°.

In a second experiment, pots of wheat seedlings grown at 20° were exposed to temperatures of 7° or 0° for 48 hours, or −10° for 24 hours, inoculations being made at sowing and again after the exposures. The different temperatures had no effect on the degree of infection that finally resulted.

In a third experiment, plants grown in sand in Petri dish covers were exposed to the same changes of temperature as in the second experiment and after chilling the seedlings were inoculated and then placed in a saturated atmosphere. The temperature changes had no effect on the degree of infection but infection was more severe than in experiments one and two.

In a fourth experiment designed to ascertain the environmental conditions resulting in optimum infection, Professor Delos and Picardie wheat was sown on 4th and 5th February in pots which were kept at 20° until emergence on the 14th after which some of the pots were placed in a greenhouse at 20° and the remainder in an unheated greenhouse; some pots in each series were kept at saturation point. In each series inoculations were effected at sowing or on emergence, or on both dates. Examinations of the sheaths showed that microsclerotial plaques developed first on the plants kept at 20° in a saturated atmosphere and inoculated at emergence or both at sowing and emergence, but later on infection became general and was the same in all pots. Measurements of the diameter of the base of 50 uninfected and 50 infected seedlings averaged 3·04 and 1·99 mm., respectively, for Professor Delos wheat and 2·48 and 1·63 for Picardie.

When Professor Delos seedlings (generally considered highly susceptible), l'Institut de Gembloux (moderately resistant), and Jubilé (resistant) were grown on sand in Petri covers, inoculated on emergence, and kept in humid conditions, all three varieties became equally affected. Of 15 varieties grown in pots, inoculated

at sowing and one month later and kept in humid conditions, most appeared to be highly susceptible and none as resistant as Picardie.

Field experiments showed that both early sowing in autumn and early infection favoured severity of attack. With spring sowing infection was much reduced.

Replies to a questionnaire sent out to farmers indicated that early sowings (end of September and early October) favour intensity of attack. The disease is very intense when wheat follows barley or wheat. Infection is more severe in low-lying areas, damp places, and hillsides exposed to the rain than elsewhere. Manuring does not appear to have an important effect. On the whole the replies suggested that deep sowing favours attack. Almost all the varieties grown by the different farmers appeared to be susceptible. Of 24 specimens of stubble examined, 19 showed the presence of *C. herpotrichoides*, 7 of *Leptosphaeria herpotrichoides*, 3 of *Ophiobolus graminis*, and 2 of *Wojnowicia graminis*.

Alfaro (A.). **El Ácaro Pediculopsis graminum Reut. y el hongo Nigrospora oryzae (Berk. et Br.) Petch, en asociación parasitaria sobre Tigos aragoneses.** [The Acarid *Pediculopsis graminum* Reut. and the fungus *Nigrospora oryzae* (Berk. & Br.) Petch in parasitic association on Aragonese Wheat.]—*Bol. Pat. veg. Ent. agríc., Madr.*, xvi, pp. 321–334, 12 figs., 1946.

A disease of wheat in the province of Aragon, Spain, attributed to the joint intervention of the mite *Pediculopsis graminum* and *Nigrospora oryzae*, developed in dry patches at the end of May, 1945. At this time none of the ears had emerged from the last leaves, which were still enveloped in their sheaths and twisted at the base, first to the right and then to the left, with a resultant reduction of 20 per cent. of the crop in some plots. The spikelets were killed in the incipient stage of development. Within the leaf enclosing the ear and on its basal node were some whitish hyphae with an abundance of black conidia, among which diminutive mites were swarming. The globose, whitish masses situated between the disorganized spikelets, and especially near the basal node, were found to be gravid females of *P. graminum*, from which legions of fresh mites proceeded.

Inoculation experiments on potted wheat plants with suspensions of conidia collected in the autumn gave negative results, except for a few cases in which mites were added, but those carried out with the fungus in the spring were successful.

The association between *P. graminum* and *N. oryzae* aggravates the damage inflicted by either partner alone. The non-gravid females transport the conidia of the pathogen in their abdominal sacs, while the mite in its turn feeds on the fungus and the decomposed host tissues, though quite capable of maintaining itself unaided on the ears.

Lejeune (A. J.). **A note on the reaction of certain Barley varieties to race 15 B of stem rust (Puccinia graminis tritici Erikss. and Henn.).**—*Sci. Agric.*, xxvii, 4, pp. 183–185, 1947.

During 1946, 28 named barley varieties and 41 hybrids were tested for susceptibility to race 15 B [*R.A.M.*, xxiv, p. 142] of stem [black] rust [*Puccinia graminis tritici*; ibid., xxvi, p. 49] in Winnipeg. The infection percentages on the susceptible varieties were 70 for race 15 B and 80 for the other races used. The reaction of all varieties to race 15 B and the other races was essentially identical, the normally resistant varieties, Peatland and Chevron, being resistant, and the normally susceptible varieties highly infected in both cases. Regent, Renown, and Thatcher, however, normally resistant to the common races, were severely infected with 15 B. Of the 41 hybrids tested, 35 of Peatland parentage were selected for resistance to the races of black rust other than 15 B.

In view of these results, barley-breeding programmes including resistance to black rust need not be interrupted in order to add resistance to race 15 B if Peatland

or Chevron or possibly the other known resistant varieties are being used as the source of resistance.

Poehlman (J. M.). **Sources of resistance to loose smut, Ustilago nuda, in winter Barleys.**—*J. Amer. Soc. Agron.*, xxxix, 5, pp. 430–437, 1947.

This is a tabulated report of the responses of 65 winter barleys to artificial inoculation with loose smut (*Ustilago nuda*) over a four-year period (1943–46) in Missouri [*R.A.M.*, xxv, p. 30]. Not more than two of the 42 awned varieties (which included rough and smooth selections of the Tennessee winter type, foreign introductions, and selections from composite crosses) were resistant, namely, Kentucky 6 and Bulgarian, and these were only tested in two years. Of 23 hooded types, 17 were resistant, all springing from one of the Tennessee Beardless varieties or Missouri Early Beardless [ibid., xxvi, p. 101].

Ludwig (R. A.). **Health condition of Quebec grown Oat and Barley seed samples.**—*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 18–20 [? 1947].

Of 45 samples of oat seed grown in 1942 in widely scattered parts of western Quebec, 16 showed no smut [*Ustilago avenae* and *U. kolleri*] spores per seed, 5 showed a trace to 500, 5 showed 501 to 1,000, 5 showed 1,001 to 2,000, 6 showed 2,001 to 5,000, 2 showed 5,001 to 10,000, 3 showed 10,001 to 20,000, and 3 showed over 20,000. Two other pathogens carried by the seed were *Helminthosporium* [*Pyrenophora*] *avenae* [see next page] and *Fusarium* sp. Of 46 samples, 5 showed no infection by *P. avenae*, 15 showed a trace to 10 per cent., 12 showed 11 to 20, 6 showed 21 to 30, 3 showed 31 to 40, 2 showed 41 to 50, and 3 showed 51 to 60 per cent. No *Fusarium* infection was present in 18 of the samples, a trace to 10 per cent. was found in 26 samples, and 11 to 20 per cent. occurred in 2 samples.

To ascertain the effect of infection by *P. avenae* on germination a test was carried out at low soil temperature using untreated and ceresan-treated seed. Of the untreated seed, only 17 of 39 samples gave a germination of 90 per cent. or over, and of these 17 only 3 gave a stand with 90 per cent. or more healthy plants. In contrast to this, 29 of the 39 samples when treated with ceresan gave over 90 per cent. germination, and of these, 26 gave over 90 per cent. healthy plants. Taking these results as a whole, it appears that 5 per cent. of the samples could safely be planted untreated, 90 per cent. would be improved by treatment, and 5 per cent. would be worthless even if treated.

Only 15 samples of barley were tested. Of these, 7 showed no infection by *H. teres*, 7 showed no *H. sativum*, and 6 no *Fusarium* sp.; 5 showed a trace to 10 per cent. *H. teres*, 5 the same of *H. sativum*, and 9 the same of *Fusarium* sp.; 3 showed 11 to 50 per cent. *H. teres*, and 3 showed 11 to 50 per cent. *H. sativum*.

These results demonstrate that treatment of cereal seed is generally necessary in Quebec, where a cereal seed-testing service would be of definite value to farmers.

Kingsolver (C. H.). **New Oat disease increases importance of seed treatment.**—*Circ. Mo. agric. Exp. Sta.* 312, 4 pp., 3 figs., 1947.

During 1946, although excellent growing conditions had prevailed and a very good crop was obtained generally, individual farmers in Missouri reported cases of premature dying, excessive lodging, and, occasionally, failure to head in oats, due to *Helminthosporium victoriae* [see above, p. 380], a disease new to this crop locally. This condition, which takes the form of a blight and a severe root rot, may cause pre-emergence damping off.

The disease was first recorded at Ames, Iowa, in 1944. In 1946, it was reported from parts of the oat belt from the Rocky Mountains to the Atlantic. Reports from all these areas record such very heavy losses that it is likely that varieties

susceptible to the new disease, even though resistant to others, will decline in popularity.

All the new oat varieties which have Victoria as a parent are susceptible, including Boone, Tama, Control, Vicland, Cedar, Forvic, Vikota, Osage, and Neosho. Such varieties are planted on about one-third of the oat acreage in Missouri, chiefly in the north-west; the principal variety grown in the other sections is Columbia, susceptible to both rusts [*Puccinia coronata* and *P. graminis*] and smuts [*Ustilago avenae* and *U. kolleri*] but resistant to the new disease. Other new oats, including Clinton, carry resistance to the rusts and smuts as well as to *H. victoriae*.

Seed treatment with new improved ceresan ($\frac{1}{2}$ oz. per bush.) gives partial control.

Leblond (D.). **Résultats d'observations préliminaires sur l'effet comparé de la formaline et du ceresan contre les maladies des grains de semence des céréales.** [The results of preliminary observations on the comparative effect of formalin and ceresan on cereal seed diseases.]—*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 60–61 [? 1947].

A field at St. Vallier de Bellechasse, Quebec, was sown with oat seed, untreated, treated with formalin, and treated with ceresan. When the plants were 6 to 8 in. high it was found that infection mainly due to *Helminthosporium* [*Pyrenophora*] *avenae* [*R.A.M.*, xxv, pp. 256, 296 and preceding page] averaged 10·7, 4·2, and 1 per cent., respectively, for the three lots. Germination tests in the laboratory gave 90 per cent. germination for the untreated seed and 94 per cent. for the treated, whether formalin- or ceresan-treated, but germination was less vigorous in the former owing to the presence of moulds, mainly *Alternaria*, *Penicillium*, and *Cephalothecium* [*Trichothecium*]. The untreated, formalin-treated, and ceresan-treated seed showed, respectively, 74, 34, and 0 per cent. moulds.

As regards smut [*Ustilago avenae* and *U. kolleri*: ibid., xxvi, p. 196], there were about 40,000 spores per grain, which when sown untreated yielded about 50 per cent. smutted panicles, though only traces were found on the plants from the treated seed. The three treatments gave, respectively, on the harvested seed 129,000, 4,000, and 450 smut spores per seed, while germination was, respectively, 80, 84, and 89 per cent. and weight was slightly in favour of the ceresan-treated seed.

Chowdhury (S.). **A Gibberella blight of Rye hitherto unrecorded from India.**—*Curr. Sci.*, xvi, 5, pp. 152–153, 3 figs., 1947.

A severe blight of rye ears was observed for the first time at the Upper Shillong Farm, Assam, in August, 1946. The blight may attack the heads at any point, usually affecting one spikelet, but may later spread to others. The first indication of infection consists of water-soaked areas, the glumes being slightly brown, which later dry out and appear ripened. If the infection spreads into the radius at the base of the spikelet and completely girdles it, the head above will dry up and die. After some time a slightly pink, later salmon, cottony fungus growth appears on the dead surface. In the diseased heads the grains are frequently affected, resulting in light-weight, shrivelled kernels. The fungus was identified as *Gibberella saubinetii* [*G. zeae*] and its occurrence reported for the first time in India. A specimen has been placed in the Herb. Crypt. Ind. Orient., Imperial Agricultural Research Institute, New Delhi.

Brown (A. M.). **Abnormal colour in sclerotia of ergot, Claviceps purpurea (Fries) Tul.**—Abs. in *Proc. Canad. phytopath. Soc., 1946*, 14, p. 14, 1946.

On 27th July, 1943, three pale buff ergot sclerotia (*Claviceps purpurea*) were collected from winter rye in the field. A tissue culture made from one was inoculated into different lots of rye plants in the greenhouse in 1944 and 1945, and abnormally coloured sclerotia were consistently produced. After stratification in moist sand

for two months at a temperature a little above freezing, some of these sclerotia were removed to room temperature; ten days later, several fructified and liberated ascospores. Ten single-ascospore cultures were secured, each from a separate sclerotium, and these were used to inoculate rye in the greenhouse. The plants inoculated with three of the cultures gave abnormally coloured sclerotia, while those inoculated with the remaining seven produced normally coloured sclerotia. These results indicate that the abnormally coloured ergot, when completing its life-cycle, segregated for colour.

Stoll (A.) & Brack (A.). **Über die Entstehung von Sklerotien des Mutterkornpilzes (Claviceps purpurea) an den obersten Halmknoten des Roggens.** [On the development of sclerotia of the ergot fungus (*Claviceps purpurea*) on the uppermost haulm nodes of Rye.]—*Ber. schweiz. bot. Ges.*, liv, pp. 252–254, 4 pl., 1944. [Received July, 1947.]

It has generally been assumed that the formation of true ergot (*Claviceps purpurea*) sclerotia is restricted to the primordia of the ovary in the ears of Gramineae, but in the course of mechanical inoculations with a conidial suspension of the fungus on a growing rye crop in Switzerland [*R.A.M.*, xxv, p. 65] the haulm nodes were occasionally punctured and sclerotia developed on those near the top of the stem. Further attempts to induce sclerotial formation by the systematic inoculation of the nodes gave negative results until in a new series of tests the ears were bent over, interrupting the flow of sap to the floral rudiments; this led to the typical production of honeydew, followed by sclerotia. The honeydew did not appear until about a month after the inoculation of the nodes as against 10 to 14 days in the case of ear infection immediately before flowering.

The sclerotia arising from the nodes contain the same specific, highly active ergot alkaloids as those developing on the ears. For instance, colorimetric determinations of three nodal sclerotia gave contents of 0·264, 0·169, and 0·134 per cent. ergotamin as compared with an average of 0·3 per cent. for those produced in the normal manner. The main difference between the sclerotia from the two locations lies in their shape, those formed on the nodes being irregular and deeply cleft, while those from the ears are perfectly regular.

Pathology and mycology of Corn.—*Rep. Ia agric. Exp. Sta., 1945–46*, Part II, pp. 49–52 [? 1947].

I. E. Melhus and G. Semeniuk [cf. *R.A.M.*, xxv, p. 555], using their method of inoculating maize plants with *Ustilago zeae* [*U. maydis*: ibid., xxv, p. 96], found that out of 70 specimens from the Corn Belt, 48 south-western 'Indian' corns, and 77 collections from Mexico [ibid., xxv, p. 72] and Guatemala, three collections from Mexico and 11 from Guatemala appeared to possess some resistance.

A study of the nature of disease resistance in maize and methods of measuring was made by G. Semeniuk, W. E. Loomis, C. S. Reddy, E. W. Lindstrom, and G. F. Sprague using maize rust (*Puccinia sorghi*) [*P. maydis*], which was more prevalent in Iowa in 1945 than in the preceding years, causing most damage to inbred lines. Greenhouse experiments with over 100 inbred lines and 50 single crosses of U.S. dent maize showed all to have marked susceptibility in the seedling stage. The relationship between field susceptibility and seedling susceptibility in the greenhouse appears to be obscure. A brief description is given of a phyllody and witches' broom development in field-grown hybrid maize noted in 1945 in low-lying wet areas of Iowa. Some plants were stunted, others abnormally tall with twice the normal number of leaves and extra leafy shoots, while normal-sized plants showed stimulated axillary shoot development and phyllody.

I. E. Melhus, G. Semeniuk, C. S. Reddy, and J. R. Wallin carried out a search from July, 1945 to May, 1946 for resistance to maize root necrosis [*Pythium*

graminicola: ibid., xxiv, p. 54; xxv, p. 544, and above, p. 381]. About 1,400 lots of native and exotic maize were tested in 36 trials, using a pathogenic isolate of the fungus from the seedling roots of maize grown near Kelly, Iowa, in 1944. Comparable lots of inoculum of the same age were used for infesting the soil, two inbreds R4 and Hy of known reaction to *P. graminicola* being included in each trial. Twenty-one days after planting the seedling roots were washed and the severity of the parasite measured according to reduction in seedling height and the amount of necrosis and root development. The susceptibility varied widely with each lot and those resistant to *P. graminicola* are undergoing further tests at the Tropical Research Centre, Guatemala. The optimum temperature for the disease was 15° C. The amount of root necrosis was directly influenced by the time lapse between soil infestation and planting of the seed. When steamed soil was allowed a lapse of several days before infestation, necrosis was markedly reduced. Observations in various parts of Guatemala revealed that there was little or no root necrosis of plants up to 2 ft. tall.

Butler (F. C.). **Ear, cob, and grain rots of Maize.**—*Agric. Gaz. N.S.W.*, lviii, 3, pp. 144–151, 20 figs., 1947.

To assist diagnosis in the field and to provide a guide to the selection of disease-free maize grain for seed purposes, descriptions are given of cob rots found in New South Wales. *Gibberella moniliformis* [*G. fujikuroi*] and *G. fujikuroi* var. *subglutinans* [*R.A.M.*, xv, pp. 280, 359] are commonly responsible for rotting of individual grains or localized areas on the cob. Only occasionally do they cause any general rotting of the tissues. A streaking and bleaching of the grain, from the tip towards the dent end, sometimes indicates internal infection by *G. fujikuroi*, but may be due to infection by *Cephalosporium acremonium* [cf. ibid., xvi, p. 168] or other fungi. Severe internal infection, particularly by *G. fujikuroi* var. *subglutinans*, is often shown by a reddish-purple discoloration in germinating grains.

G. saubinetii [*G. zeae*: ibid., xv, pp. 280, 359] generally causes an extensive generalized cob rot extending for some distance from the tip. Occasionally it causes a butt-end rot, and sometimes the whole ear may be rotted.

Dry rot caused by *Diplodia zeae* [ibid., xv, p. 280] sets up a progressive general rotting of the ear from either the tip or butt-end of the cob.

Cob rot due to *Basisporium gallarum* [*Nigrospora oryzae*: ibid., xi, p. 222: xxiii, p. 383] is easily recognized by the black-speckled bases of the grains, and black bundle disease due to *C. acremonium* by the reddish or purplish colour at the 'dough' stage, and the blackening of the vascular bundles. *Penicillium* species [cf. ibid., xxiii, p. 480; xxiv, p. 225] seldom cause extensive rotting in uninjured maize when the cobs and grain are in active growth, but if the cobs are allowed to remain too long on the stalk in moist weather, or if the ears are dried under poorly ventilated conditions, infection may occur especially at the tip-end.

Aspergillus niger [cf. ibid., xxiv, p. 54] causes a black mould on the ear which often follows insect attack in moist seasons. *A. flavus* [cf. ibid., xxiii, p. 333] causes a yellow mould on the ear. Species of *Penicillium* and *Aspergillus*, together with other moulds, are also found on germinating maize grain, on stored grain, and even on grain still on the cob in the field. Attack in the field generally follows injury by birds or insects to the grain. Other fungi associated with such infections include species of *Rhizopus*, *Alternaria*, *Acrostalagmus*, *Trichoderma*, and *Cephalothecium* [*Trichothecium*]. In addition, species of *Mucor*, *Torula*, *Monilia* [? *Candida*], *Hormodendrum*, and *Sporotrichum* may occur on the grains. They impair germination and may cause considerable injury, or even result in the death of the young developing shoots or roots.

The control measures recommended [ibid., xvii, p. 656; xx, p. 558] consist in the careful selection of clean, healthy seed both in the field and the barn, improved

cultural practices, and (as a routine measure) seed-dusting with an organic mercury compound at the rate of 2 oz. per bush.

Hayes (H. K.), Rinke (E. H.), & Tsiang (Y. S.). **Experimental study of convergent improvement and backcrossing in Corn.**—*Tech. Bull. Minn. agric. Exp. Sta.* 172, 40 pp., 8 figs., 1946.

Details are given of a study of convergent improvement in maize carried out in Minnesota, in the course of which from the back-cross programme of (B 164 × 37) B 164, where B 164 is an inbred susceptible to smut [*Ustilago zeae*] and 37 is smut-resistant, it was possible to obtain improved lines resembling B 164 which were somewhat highly smut-resistant.

Goidànich (G.) & Scardovi (V.). **Esperienze sulla suscettibilità al 'carbone della cariosside'—prodotto da Sphacelotheca sorghi (Link) Clinton—di alcuni Sorghi zuccherini coltivati in Italia.** [Experiments on the susceptibility to covered smut—caused by *Sphacelotheca sorghi* (Link) Clinton—of certain sweet Sorghum varieties cultivated in Italy.]—*Agricoltura ital.*, xlvi (1° N.S.), pp. 243–260, 1 pl., 1946.

This is an expanded account of a paper on sorghum covered smut (*Sphacelotheca sorghi*) already noticed from another source [*R.A.M.*, xxvi, p. 197].

Venkatarayan (S. V.). **Diseases of Ragi (Eleusine coracana).**—*Mysore agric. J.*, xxiv, 2, pp. 50–57, 1946.

A brief account is given of the occurrence of the following diseases of *Eleusine coracana* in India, summarized from the pertinent literature: leaf blight and foot rot (*Helminthosporium nodulosum*) [*R.A.M.*, xiv, p. 439; cf. also xvii, p. 699], blast (*Piricularia* sp.) [ibid., xxi, p. 363], smut (*Ustilago eleusinis*) [ibid., iii, p. 571], mustiness in storage (*Heterosporium* sp.), green-ear disease (*Sclerospora* sp.), wilt (*Sclerotium rolfsii*) [ibid., xii, p. 267], mosaic-type mottling [ibid., xxvi, p. 12], leaf spots (*Cercosporella* sp. and *Acrothecium lunatum*), the former reported by Narasimhan in *Rep. Dep. Agric. Mysore*, 1920–1, and the latter by Butler & Bisby [*R.A.M.*, xi, p. 545] and one or two disorders of undetermined etiology, possibly connected with adverse soil factors.

Lin (K. H.). **Observations on Citrus diseases in China.**—*Plant Dis. Reptr*, xxxi, 3, pp. 107–111, 1947. [Mimeographed.]

During 1941 and 1943 evidence was found of 20 citrus diseases, 12 of major importance, in the Chinese provinces of Fukien, Kiangsi, and Szechuan. Scab (*Elsinoe fawcettii*) [*R.A.M.*, xxiv, p. 441] is most severe on tangerine, *Citrus poonensis*, and grapefruit, particularly in older closely planted orchards in Fukien, and on *C. kinokuni* in Kiangsi. Canker (*Phytomonas* [*Xanthomonas*] *citri*) is most prevalent on sweet orange, lemon, and *C. tankan* in Fukien. A bark disease suspected by the author to be related to psorosis, but considered by H. S. Fawcett to be similar to bark rot or to Florida gummosis [ibid., xi, p. 365], is common in Fukien and commonly attacks older tangerine trees. In some orchards over 50 per cent. of the trees are affected. Decline, which affects mostly trees under 12 years old, appears to be due to improper water relations in the soil and is sometimes aggravated by lack of fertilizers. It is most serious in Fukien and is the limiting factor in the growing of *C. poonensis* in South China. Convex gum, a new disease already reported [ibid., xxii, p. 384], causes considerable damage in Fukien to nursery trees of sweet orange only and young orchards of Kushanchow Kan oranges. Greasy spot is common in Fukien and Kiangsi on sweet orange and grapefruit and causes considerable damage to susceptible species in South China. Sooty mould (*Meliola*

sp.) is most prevalent in Fukien on tangerine, grapefruit, and sweet orange and to a lesser degree on sweet orange in Kiangsi. Blue and green moulds (*Penicillium italicum* and *P. digitatum*) occur mainly in Fukien, but the blue mould is common everywhere [see next abstract]. Black spot (*Phoma citricarpa*) [ibid., xxii, p. 430] is serious in Fukien only, on *C. poonensis*. Brown rot gummosis caused by *Phytophthora* spp. was confined to Fukien, where it was serious in several sweet orange orchards. *Diplodia* gummosis [*D. natalensis*] caused damage in a tangerine orchard in Szechuan.

Among the disorders of minor importance were magnesium deficiency of sweet orange in Fukien and Kiangsi, melanose (*Diaporthe citri*) on sweet orange in all three provinces, and oleocellosis [also known as 'gooseflesh': ibid., xvi, p. 94, xix, p. 86, *et passim*] in Fukien on orange and lemon and in Szechuan on orange.

Hwang (L.), Chow (C. M.), & Ching (I.). **Further study on storage experiments of Kwangsi Sha-Tien Pummelo (Citrus grandis Osbeck) with special reference to disease control.**—*Kwangsi Agric.*, vi, pp. 12–25, 2 graphs, 1946. [Chinese, with English summary.]

Blue mould (*Penicillium italicum*) [see preceding abstract] was the major cause of spoilage in stored grapefruit in the authors' experiments, being responsible for 79 per cent. of the total incidence of infection at the end of 217 days. Next in importance (in the order named) came *Phomopsis* stem-end rot (*Diaporthe citri*), anthracnose (*Colletotrichum gloeosporioides*), *Diplodia* stem-end rot (*D. natalensis*), *Fusarium* sp., and green mould (*P. digitatum*). The best control, especially of blue mould, was secured by five minutes' immersion of the fruit in a 6 per cent. borax solution [cf. *R.A.M.*, xiii, p. 763; xvi, p. 744], wrapping in copper-impregnated tung-oil paper, and packing in earthenware jars. Almost equally effective, notably against *D. natalensis* and *Diaporthe citri*, was a dip in a 4 per cent. mixture of sodium and potassium carbonate, followed by packing in earthenware jars. Fruit packed with fresh pine needles in earthenware jars, with or without chemical treatment, showed the least loss in weight. *C. gloeosporioides* was not amenable to control by these methods.

Calavan (E. C.). **Shell bark of Lemons.**—*Calif. Citrogr.*, xxxii, 6, pp. 232–233, 263–265, 16 figs., 3 diags., 1947.

Shell bark attacks most Eureka lemon plantings over 16 years old in California and has also been observed frequently on six-year-old trees near the coast. No United States variety appears to be immune. Since 1921 it has been believed that the disease is caused by *Diaporthe citri* [*R.A.M.*, xxv, p. 558] but this is now very doubtful. Several studies were recently made on shell-bark lesions and bark thickness at Riverside [ibid., xxiv, p. 97] and Corona. Sections cut through primary lesions in Eureka lemon bark revealed that the necrotic areas originate in the middle bark rather than at the bark surface or in wounds and these lesions contain no fungi. Old lesions contained several fungi but with no species consistently present. Some secondary fungi often found in 'active' lesions include *Alternaria citri* and other *A.* spp., *Botryosphaeria ribis*, *Botrytis cinerea*, *Colletotrichum gloeosporioides*, *D. citri*, and *Diplodia* and *Fusarium* spp. Wound inoculations with these fungi resulted only in gumming lesions, but it is thought that they all may accelerate the extension of shell bark lesions. Lemon bark rarely shows signs of shelling before it is 4 mm. thick and in the early stages the south-east side of the trunk where the bark is thickest is usually the first to shell. Owing to the non-fungal nature of the primary lesions fungicides are of no use in controlling the disorder. Breeding and selection may check shell bark in the future but meanwhile care should be taken in the choice of parent trees to reduce its premature appearance.

KNIGHT (R. L.). **The genetics of blackarm resistance. V. Dwarf-bunched and its relationship to B_1.**—*J. Genet.*, xlviii, 1, pp. 43–50, 1 pl., 1947.

During the course of breeding American Upland cotton (*Gossypium hirsutum*) for resistance to blackarm [*Xanthomonas malvacearum*: cf. *R.A.M.*, xxiii, p. 341; xxvi, p. 200], the F_2 generation of a cross between Uganda B31 and 514 included a number of dwarfed plants with abnormally short internodes. This 'dwarf bunched' character is due to two recessive genes *da* and *db*. Dwarf-bunched was shown to be closely linked to the blackarm-resistance gene B_1 and it is thought that *da* may possibly be identical with B_1. The use of B_1 within the *C. hirsutum* group, therefore, may result in the production of this dwarf-bunched type. This would not occur with *G. barbadense* which carries the two normal dominant genes *Da* and *Db*.

GROSZMAN (A.). **Cinco anos de melhoramento de Algodão pelo Departamento de Genética, Estatística e Biometria da Escola Superior de Agricultura do Estado de Minas Gerais—Vicosa.** [Five years of Cotton improvement by the Department of Genetics, Statistics, and Biometry of the Higher School of Agriculture in the State of Minas Gerais—Vicosa.]—*Ceres*, v, 26, pp. 94–115, 5 pl., 4 figs., 1 diag., 1943. [English summary. Received June, 1947.]

Reference is made to a collection of 13 species of *Gossypium* and a large collection of cotton varieties maintained by the Department of Genetics. Two hybrids of *G. barbadense* and *G. hirsutum* were resistant in tests for reaction to *Verticillium albo-atrum* [*R.A.M.*, xxiii, p. 333]. In the F_2 of a cross between Texas Green Lint and Virescent, an entirely new leaf colour described as 'ferrugem' (rust) has appeared, and further studies on its inheritance are to be made. There is a description of the system of seed production and distribution.

GARRETT (S. D.). **Report on an investigation of Verticillium wilt.**—*Emp. Cott. Gr. Rev.*, xxiv, 2, pp. 101–102, 1947.

This is the final report on four years' investigation into *Verticillium* wilt [*V. albo-atrum*: cf. *R.A.M.*, xxiv, p. 449] of cotton carried out from April, 1940, to March, 1944, at Rothamsted Experimental Station. The prospects for controlling *Verticillium* wilt are poor because its mode of spreading is typical of a vascular parasite, the transmission from diseased to healthy roots being by root contact although an infected plant does not become infectious to its neighbours until the penultimate phase when the fungus develops on the outside of the root. Soil conditions can only influence the progress of the disease indirectly by influencing the susceptibility of the plant. Infection is favoured by a high level of nutrition in the host plant, especially by nitrogen and by conditions favouring photosynthesis and growth. Manurial treatment is therefore useless in combating the disease [ibid., xxiii, p. 154]. Although this view is supported by other investigators who say that *Verticillium* wilt is more prevalent on soils well supplied with organic matter, it has yet to be confirmed in Uganda. Breeding and selection of wilt-resistant varieties offers the only prospect of control.

DE VASCONCELOS (A. T.) & DE OLIVEIRA (B.). **Nota acerca de 'Saprolegnia' parasitica Coker e da acção de certos sais sobre o seu desenvolvimento.** [Note on *Saprolegnia parasitica* Coker and on the action of certain salts on its development.]—*Brotéria*, xvi, 1–2, pp. 15–19, 2 figs., 1947.

Saprolegnia parasitica was reported by Da Camara *et al.* in 1936 [*R.A.M.*, xvi, p. 563] as a parasite of *Carassus auratus* in Portugal, where it has since been observed from time to time, an outbreak of major importance having occurred among carp (*Cyprinus carpio*) in the Lisbon Colonial Garden in 1939. Other species affected in

different parts of the country include *Gasterosteus aculeatus*, on an isolate from which the present study was conducted. Chlamydospores were found in profusion on Dox's and maize meal agar, and zoospores in a liquid medium only [cf. ibid., xviii, p. 799]. The growth of the fungus was inhibited by the addition to Dox's liquid medium of calcium chloride or sodium borate at 0·25 per cent. Inoculation experiments on *Carassus auratus* gave negative results.

Borges (Maria De L. V.). **Uma doença do Linho nova para Portugal.** [A Flax disease new to Portugal.]—*Brotéria*, xv, 3, pp. 129–136, 1 map, 1946.

The 'pasmo' disease of flax (*Sphaerella linorum*) was observed for the first time in Portugal in 1941 at the National Agronomic Station, Sacavém. The fungus was isolated in pure culture on several standard media, of which Dox's proved to be the most suitable, with an optimum growth temperature of 25° C. There were no appreciable differences in the reaction to inoculation with *S. linorum* of a number of indigenous and foreign flax varieties. The first symptoms appeared on the leaves and stems on the 11th and 21st days, respectively, after infection, while pycnidia were not observed until the 28th. The disease was shown to be seed-borne and was not effectively combated by ten minutes' immersion in a 1 per cent. mercuric chloride solution.

Payette (A.) & Lachance (R. O.). **Désinfection superficielle de la graine de Lin en vue de l'analyse biologique.** [Surface disinfection of Flax seed for biological analysis.]—*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 101–104, [? 1947].

Preliminary experiments on the surface disinfection against *Fusarium lini*, *Colletotrichum lini* [*C. linicola*], *Alternaria* sp., and bacteria generally [*R.A.M.*, xxiii, p. 487] of flax seed intended for biological analysis (degree of infection by different organisms, etc.), indicated that on the whole the most suitable method, in comparison with cuprocide dusting and mercuric chloride solution, was a one-minute steep in a 10 per cent. solution of calcium hypochlorite.

Lachance (R. O.) & Payette (A.). **Efficacité relative de divers fongicides contre l'anthracnose du Lin.** [Comparative efficacy of various fungicides against Flax anthracnose.]—*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 105–109, [? 1947].

Preliminary laboratory and greenhouse tests carried out in Quebec on the control of *Colletotrichum lini* [*C. linicola*] by seed treatments [*R.A.M.*, xxvi, p. 55 and preceding abstract] showed that all the disinfectants used increased emergence by about 20 per cent. The best control as measured by the percentage of anthracnose on 12- to 14-day old seedlings was given by ceresan, followed by arasan, and then by spergon. Semesan was about as effective as spergon, while semesan jr. was not effective. The optimum dosage was 2 oz. per minot [1 minot = 39 l.] in every case. With ceresan, 1½ oz. per minot gave as good control as 2 oz. of arasan.

When healthy flax seed was sown in soil experimentally inoculated with *C. linicola* ceresan again gave the best seed protection, the optimum dosage being 2 oz. per minot. Spergon and semesan jr. gave some protection, but arasan and semesan were not satisfactory. Further work is in progress.

Wilson (Irene M.). **Observations on wilt disease of Flax.**—*Trans. Brit. mycol. Soc.*, xxix, 4, pp. 221–231, 1 pl., 6 graphs, 1946.

During 1942, work was begun at Aberystwyth on the effects of seed treatments for the prevention of seed-borne diseases of oil varieties of flax [cf. *R.A.M.*, xxiv, p. 58]. The fungicides used were nomersan and agrosan G, applied in fine powder form at the rate of 0·6 per cent., while the flax varieties sown, on an experimental

scale, were La Plata (regional strains from Argentina) and Bison and Redwing (uniform, carefully selected seed from Canada). Sowing was carried out on 20th May. Two seed-borne fungi caused serious trouble, *Polyspora lini* and *Fusarium lini* [cf. ibid., xxvi, p. 56]. Before the end of the third week after sowing, many seedlings were in a dying condition as a result of wilt due to *F. lini*, the symptoms agreeing with those described by Millikan [ibid., xxiv, p. 505]. All the varieties became affected, those most severely attacked being Redwing and La Plata.

When isolates of *F. lini* from the original seed of Redwing and from parts of diseased plants were used to infect pots of steam-sterilized soil in which healthy La Plata seed was sown, all the plants (kept at 23° to 24° C.) developed wilt and died in 20 to 37 days, the fungus being re-isolated from the dead seedlings.

Untreated Redwing plants produced seed heavily infected with *P. lini* and in a laboratory test with 400 seeds nomersan [ibid., xxii, p. 358] reduced infection from 55 to 2 per cent., while agrosan G suppressed it completely. On Bison seed, nomersan reduced *F. lini* infection from 14 to 3 per cent., and agrosan G to 1 per cent.

In 1944, La Plata seed free from all seed-borne pathogens except about 0·5 per cent. of *P. lini* was treated with nomersan or agrosan G or left untreated, and sown on 7th May in a plot where a crop heavily infected with *F. lini* had been grown the year before, the diseased seed used for this crop also having carried *P. lini*. During the 1944 season disease due to *P. lini* did not become conspicuous until the crop was ripening. Wilt due to *F. lini*, on the other hand, caused severe damage. Germination was about 30 per cent. in the treated seed and 13 per cent. in the untreated, as against 95 per cent. in a neighbouring bed of similar soil free from *F. lini*. The higher yield from the treated seed was entirely due to the greater stand. High mortality from wilt coincided with dry, sunny periods. Heaviest destruction occurred in the very early stages of germination, and a further conspicuous fall in the number of surviving plants ensued in the sixth to seventh week after sowing, in the latter half of June, and again in the first part of August, though the older plants died less rapidly than the younger ones. These observations confirm the view that a relatively high soil temperature favours infection by *F. lini*.

In 1945, the same infested soil, in its fourth year under flax, was sown with La Plata seed free from disease organisms except for 0·5 per cent. of *P. lini*. Plots were sown with untreated seed and seed dressed with nomersan or with an 8 per cent. solution of ceresan U 564. Similar seed, untreated, was sown in a plot not previously used for flax. Sowings were made on 18th April and 9th May. In both sowings the only reduction of stand in the plots free from *F. lini* was a slight mortality in the seedling stage due entirely to *P. lini*. The number of living plants in the infested soil, on the other hand, declined continuously, particularly during the hot weather in August. The symptoms resembled those due to *F. lini*, but the incidence of *P. lini* was also greater than in the control plots. Most of the older plants showed infection by both fungi. The moisture content of the seed before treatment was 8·1 per cent. and the period of storage was four to seven weeks, but the results obtained clearly showed that ceresan is a very useful protection against stem break due to *P. lini*. In both sowings, the stand curves for the untreated and nomersan-treated seed were very close, and 15 to 20 per cent. higher than the ceresan curve.

It is concluded that *F. lini* may cause severe damage to flax even in the climatic conditions prevailing in Britain. La Plata was highly susceptible, Redwing fairly so, and Bison somewhat more resistant. It was confirmed that flax can be attacked at any stage of development and that incidence is closely correlated with soil temperature. Locally, wilt was usually accompanied by attack by *P. lini*. Seed dressings gave considerable protection during the early stages of germination, but were less effective against attack on older plants.

McWhorter (F. P.). **Scale tip rot of Lilium longiflorum in the Pacific Northwest.**—*Plant Dis. Reptr*, xxxi, 4, pp. 159–161, 1947. [Mimeographed.]

The scale rot of *Lilium longiflorum*, variety Croft, continued to be widespread in coastal plantings of Oregon and California. The name 'scale tip rot' is proposed for this disease, which does not affect the growth of the plants but mars the appearance of the bulbs and provides entry for agents of decay.

Two types of symptoms have been noticed: either the tips and outer surfaces of the scales are discoloured with pitted, dark lesions, or they wither without prominent discoloration. The first type is far more usual and yielded *Cylindrocarpon radicicola* [*R.A.M.*, xviii, p. 154] as a dominant fungus organism in 1944. Similar studies in 1945 failed to detect *C. radicicola*, but several species of *Fusarium* [ibid., xxii, p. 434] and occasional dematiaceous isolates were found. The typical form of the disease was not reproduced when these isolates were inoculated into scales in Petri dishes and into bulbs in sand cultures, but the atypical form was reproduced with some species of *Fusarium*. Fungicidal applications to bulb tips in both years failed to control the disease. It is suggested that physiological factors cause a breakdown of the integumentary tissue which provides for the subsequent invasion by fungi.

Jørstad (I.). **Løvemunnrust og Løvemunnskimmel. To nyinnvandrete parasittsopper.** [Snapdragon rust and Snapdragon mildew. Two newly introduced parasitic fungi.]—*Norg. GartForen. Tidsskr.*, xxxvi, pp. 497–498, 1946. [English summary.]

In connexion with the appearance in south-western Norway of snapdragon rust (*Puccinia antirrhini*) and mildew (*Peronospora antirrhini*), the geographical distribution, symptomatology, and life-histories of the two pathogens are briefly described.

Puccinia antirrhini [*I.M.I.* map 40] has spread very rapidly in Europe since its discovery in France in 1931 [*R.A.M.*, xiii, p. 269] and was detected in Denmark and Sweden as early as 1934 and 1935, respectively [ibid., xiv, p. 239; xvi, p. 679].

Peronospora antirrhini was first observed as a parasite of the cultivated snapdragon (*Antirrhinum majus*) near Oslo in 1935, after which it did not reappear until 1944, when it was again reported from the same locality; a further outbreak occurred in the extreme south of the country in 1946. The mildew did not reach Denmark and Sweden until 1943 [ibid., xxv, p. 454].

Jones (F. R.) & Smith (W. K.). **Segregation of resistance to bacterial wilt in crosses involving Grimm Alfalfa.**—*J. Amer. Soc. Agron.*, xxxix, 5, pp. 423–425, 1947.

In his doctorial thesis (University of Wisconsin, 1938) R. A. Brink concluded that resistance to bacterial wilt [*Corynebacterium insidiosum*] could be introduced by means of hybridization into any of the widely cultivated susceptible lucerne varieties [*R.A.M.*, xiv, p. 174]. From a cross between the immune A 116–15 and the highly susceptible Grimm No. 8, several F_1 plants were selfed along with the parents. From each of the 50 seedlings from the ovule parent (Grimm), 70 from the pollen parent (A 116–15), and 170 seedlings of the most productive F_1 plant, four or five cuttings were made, and the clones thus developed inoculated and planted out in the spring. Seedlings from two other F_1 plants were inoculated directly. No infection occurred in 40 per cent. of the clones from the progeny of the A 116–15, whereas none of those from Grimm or the F_2 selections escaped altogether, though a few of the latter sustained only slight damage. The two F_2 populations inoculated directly gave rise to 35 and 62 per cent. healthy plants, while two more F_2 populations from a similar cross produced 17 and 44 per cent. resistant individuals.

In the F_1 offspring of crosses between three Grimm and four immune selections the following numbers of plants were immune: Grimm 3 × T 38–11, 1 out of 10; T 28–5 × Grimm 8, 2 out of 11; Grimm 8 × A 116–15, 2 out of 7; T 37–1 × Grimm 27, 1 out of 6; Grimm 27 × A 116–15–1, 1 out of 10; and A 116–15–1 × Grimm 27, 2 out of 14.

Tucker (C. M.) & Gregory (C. T.). **Azalea root rot in Missouri.**—*Plant Dis. Reptr*, xxxi, 3, pp. 111–113, 1947. [Mimeographed.]

Azalea [*Rhododendron*] root rot has been found in two greenhouses in the St. Louis area. It was first noticed in the south [of the State] in 1942 and the St. Louis plants came from that area. Isolations from infected tissues consistently yielded *Phytophthora cinnamomi* [*R.A.M.*, xii, p. 696; xxiv, p. 295].

Bain (D. C.) & Presley (J. T.). **A leaf disease of Kudzu new to the United States.**—*Plant Dis. Reptr*, xxxi, 5, pp. 188–189, 1947. [Mimeographed.]

During the summer of 1946 leaf-spotting and firing of kudzu (*Pueraria thunbergiana*) [*P. hirsuta*] was noted in Newton County, Mississippi. Dr. C. Chupp identified the causal organism as *Cercospora pueraricola* [*R.A.M.*, xvi, p. 493]. The angular spots, about 1 to 8 mm. in diameter, are dark brown when small, their centres becoming light brown with a dark brown border when they increase in size.

A firing of part or all of the leaf margin was noticed in most cases. The spots are evident on both surfaces of the leaves; on the lower they are a pale greyish-brown without a darker border. The conidia of *C. pueraricola* are coloured, obclavate, and vary in size from 20 to 135 by 3 to 6 μ. Chupp separates this species by the pale colour, obclavate shape, and small size of the conidia.

Laporte (L. J. S.). **Nouvelle campagne contre la brûlure bactérienne du Pommier.** [The new campaign against Apple fireblight.]—*Rep. Quebec Soc. Prot. Pl., 1943–44*, p. 17 [? 1947].

Fireblight [*Erwinia amylovora*] is stated to have caused heavy losses in recent years in the apple orchards of Quebec [*R.A.M.*, xxii, p. 10; xxiii, p. 4]. Environmental conditions appear to keep it in check in commercial orchards most of the time, but it is always present somewhere though it may remain unnoticed till it breaks out with great severity. Control measures are indicated.

Brown (G. G.). **A method of topworking Pear trees for early maximum production and for reducing stony pit losses.**—*Sta. Bull. Ore. agric. Exp. Sta.* 438, 23 pp., 11 figs., 1946.

The primary purpose of top-working Bosc and Anjou pear-trees with Bartlett is to reduce losses from the stony pit virus disease [*R.A.M.*, xviii, p. 463; xxvi, p. 9], from which both varieties suffer and to which Bosc in particular is highly susceptible. As the fruit of the Bartlett is symptomless and normal in appearance, the variety can be used satisfactorily for top-working. Stony pit has spread to several fruit areas through infected nursery stock and losses in the Hood River Valley, Oregon, are often extensive. The disease was first observed [in Oregon] about 20 years ago.

From 60 to 75 Bartlett scions were grafted on to each of 17 Bosc trees in the spring of 1937, and an equal number of Bartlett buds were inserted in each tree in August. This procedure differs from the usual top-working method in the complete elimination of severe surgery, the stock growths not being removed. The average yields per tree in 1940, 1941, and 1942 were, respectively, 10·2, 10·2, and 6·2 lugs. The corresponding yields for the same years of Bartlett pears top-worked in 1938 on 10 Anjou trees were 8·7, 11·9, and 11·3 lugs, respectively. Nineteen unworked Bartlett trees in the same orchard yielded 9·2, 9·9, and 6·6 lugs, respectively.

Hildebrand (E. M.). **Internal bark necrosis (measles) of Delicious Apple in New York in relation to pH, minor element toxicity and nutrient balance of soil.**—*Plant Dis. Reptr*, xxxi, 3, pp. 99–106, 1947. [Mimeographed.]

Several investigations into this disease have been made recently [*R.A.M.*, xxvi, p. 16]. The present study was confined to a single orchard where new Red Delicious trees were planted on land where apples had been grown for 100 years. The first trees died as a result of internal bark necrosis three years later. Soil analyses showed that calcium, boron, and magnesium were deficient and the levels of manganese, iron, and aluminium were toxic. It is possible that the low pH (3·8 to 5) of the soil in which young trees were planted was caused by calcium and magnesium deficiency plus the addition of sulphur spray residues accumulated over several years in the top layer of the soil, which is the feeding range of the roots of the young trees. Applications of boron and nitrogen failed to confer any improvement in the condition. On the same site Rome Beauty, McIntosh, and Red Delicious showed abnormal leaf characteristics and also several Gold Delicious trees, two of which showed definite symptoms of internal bark necrosis.

Miller (P. W.). **Fungi associated with root lesions of the Strawberry in Oregon.**—*Plant Dis. Reptr*, xxxi, 3, pp. 90–99, 1947. [Mimeographed.]

In Oregon, besides *Phytophthora fragariae* [*R.A.M.*, xxiv, p. 325], several other root troubles affect the cortical tissues, but not the core of strawberry roots, causing dwarfing and a reduction in size of the leaves and petioles. The former turn reddish-brown in early summer before the plant eventually dies. Both the fleshy primary and fibrous secondary roots develop dark-coloured lesions which occur anywhere along the root. Both root systems rot away, the secondary roots decaying first. This black root condition [ibid., xxvi, p. 46] is especially widespread in western Oregon and has resulted in heavy losses in recent years. Investigations on the fungi associated with these lesions were carried out from 1944 to 1946 by the writer in conjunction with the Oregon Agricultural Experiment Station, and it was found that there was no specific fungus consistently present but rather several different fungi of which those most commonly found were *Ramularia*, *Rhizoctonia*, *Fusarium*, *Chaetomium*, *Penicillium*, *Phytophthora*, *Pythium*, *Verticillium*, *Oothecium*, and *Pestalotia* spp. In inoculation tests *Ramularia* and *Rhizoctonia* were found to be the most pathogenic of the genera tested, those feebly pathogenic were *Stemphylium*, *Phytophthora*, *Fusarium*, and *Verticillium* spp.

Whitehead (T.) & Wood (C. A.). **Virus diseases of the Strawberry. I. The field problem in North Wales.**—*J. Pomol.*, xxii, 3–4, pp. 119–133, 1 fig., 2 graphs, 1947.

The decline in yield of commercial strawberry plantations in the Dee Valley, Denbighshire, has gradually reduced the area under this crop locally from 750 acres in 1914 to about 50 in 1945. A study of the problem, begun in 1938, showed that the degeneration was caused solely by virus diseases [cf. *R.A.M.*, xxv, pp. 459, 460]. Both in the Dee and Conway valleys the onset of serious degeneration coincided with the introduction of new varieties, some of which proved to be symptomless carriers. Royal Sovereign is almost irretrievably ruined, and even the vigorous carriers are degenerating.

Investigations were accordingly carried out into the ecology and biology under North Wales conditions of the strawberrry aphid *Capitophorus fragariae*, the correct name for which the authors consider to be *Pentatrichopus fragariae* Theob., and a survey was made of the local commercial plantations to ascertain if any correlation could be established between aphid populations and crop degeneration. Isolated plots of vigorous, symptomless stocks of Royal Sovereign and other

varieties remained aphid-free until 1943 (since when a small number of *C. fragariae* have been recorded on some plots), and a promising industry of healthy runner production has been started. The amount and rate of serious degeneration (i.e., severe forms of strawberry dwarf, yellow edge, and crinkle) [loc. cit.] was found to be related to the intensity of the population of *C. fragariae*. In seasons of low aphid population it is easy to select vigorous, virtually symptomless runners from maiden (first-year) beds for propagation, but when infestation is high the beds become overwhelmed by disease at any age. Of aphid species commonly found on strawberry, *C. fragariae* alone was demonstrated to act as a vector. All the available evidence indicates that there is no source of the viruses apart from cultivated strawberry varieties.

C. fragariae does not 'inherit' virus infectivity from a viruliferous, viviparous parent, but is capable of picking up and transmitting a virus from crinkle-affected plants within 24 hours of birth. Transmission is possible by a single individual at all seasons. Less than two hours' feeding on an infected plant, followed by one hour on an indicator plant, may suffice to transmit a strawberry virus to the latter.

Control must be based on eradication of the aphid, or the disease foci, or both. Nicotine fumigation is, however, unlikely to prove sufficient by itself. The eradication of disease foci also presents a difficult problem. Vigorous runners can be raised from healthy plants grown in isolation in pastoral areas in North Wales and may be used to build up the healthiest possible commercial stocks [ibid., xxiv, p. 156]. But if such runners are planted near infected, older stocks, their health will break down in years of high aphid prevalence, in spite of nicotine treatment.

The final solution lies, doubtless, in the development of resistant or immune varieties that are also commercially acceptable. Meanwhile, the regular fumigation of plantations and the constant improvement of runner stocks by the present system of certification by the Ministry of Agriculture [ibid., xxv, p. 288] offer the most promising means of rehabilitating the strawberry industry.

Wood (L. K.). **Some causes of malnutrition in Cane fruits.**—*Proc. Soil Sci. Soc. Amer., 1945*, x, pp. 260–262, 1946. [Abs. in *Chem. Abstr.*, xli, 9, p. 2834, 1947.]

Fertilizer tests were carried out in Oregon with red raspberries and boysenberries on Powell silt loam, with black raspberries on Olympic silty clay, and with gooseberries on Amity silty clay. Leaf scorch, associated with a low potassium oxide content, was corrected by ample supplies of fertilizers containing this compound. The use of a complete fertilizer with a high potash ratio produced a striking increase in cover-crop growth and in berry size and yield, besides helping to prevent the development of crumbly fruits. Zinc sulphate, applied either as a salt to the row or as a spray to the leaves, increased the red raspberry yield, while copper sulphate acted similarly on the black varieties in Olympic soil. Some improvement in production was also effected by soil amendments with magnesium sulphate, while treatment with phosphorus pentoxide, combined with early autumn cover crops, was beneficial in the reduction of winter injury.

Eastwood (H. W.). **Bunchy top disease of Bananas controlled by co-operative effort.**—*Agric. Gaz. N.S.W.*, lvii, 11, pp. 571–577, 3 figs., 2 graphs, 1 map, 1946; lvii, 12, pp. 643–646, 4 figs., 1946; lviii, 1, pp. 26–30, 2 figs., 1947.

The banana-growing industry in Australia was badly crippled by the bunchy top disease [banana bunchy top virus: *R.A.M.*, xxii, p. 48] from 1923 to 1927. The first of these articles regarding the system of control administered by the Department of Agriculture in conjunction with the Banana Growers' Federation describes the devastation wrought by the disease, traces the development of the control system [ibid., viii, p. 512], and indicates the measure of re-establishment already accomplished. Up to 1934 the control measures had reduced the incidence of bunchy top

to a very low level [ibid., xv, p. 592]. In 1935, however, it broke out again because the growers reduced plantation labour. The chief weaknesses in the control scheme then were that banana plantations were too numerous for adequate inspection, negligent growers could not be dealt with soon enough, and penalization of un-co-operative growers was useless. In 1935 the Banana Growers' Federation helped growers by sending out men to spray diseased stools with kerosene [paraffin]. Although an attempt was made in some southern areas to eradicate the disease this was not the aim in the Tweed, Brunswick, and Richmond River [ibid., xix, p. 31] districts where a satisfactory control was claimed.

The second article gives a more detailed account of the current control system. The plantations are classified into (*a*) hot spots, (*b*) lightly infected, and (*c*) very lightly infected areas and are inspected more frequently (three-weekly) if more severely infected. The method of inspection varies according to the severity of the infection from close, leaf to leaf examination in bad areas to wide and random surveys where records are good. Diseased stools are recorded and then sprayed at once to kill aphids; the grower is notified and is obliged to destroy all diseased stools promptly and efficiently, measures being taken against 'faulty eradications'. Minute daily records have contributed towards annual statistics. To assist growers during the campaign a digging-out fund was introduced during 1936 but ceased operating in 1946 when it was no longer required.

In the third instalment the author describes the attempts at eradication of the disease at Yarrahappini [ibid., xxi, p. 149]. This campaign, which began early in 1937, was designed for the protection of important commercial plantations farther north. The movement and planting of suckers was prohibited from February, 1938 to September, 1945. The area was frequently and thoroughly inspected and diseased stools destroyed. Up to 1940 the disease decrease was encouraging but results have since been disappointing. Planting was permitted again in September, 1945, after a three-year period of freedom from the disease. Previously, from May, 1938, the disease had remained confined to five plantations and did not infect the healthy areas. In 1946 six infected stools were recorded. The most disconcerting aspect of the disease is that it remains dormant in the plant, a distinct setback to the campaign. During the eight years from 1937 to 1946 the Yarrahappini campaign cost the Banana Growers' Federation £3,950 and the disease still persists in one plantation. The success of the general campaign, however, is indicated by the present State acreage of 21,663 acres, only 626 acres less than in the record season of 1933–4. Bunchy top losses have been reduced from 42,305 stools (0·6 per cent. of the acreage) in 1936–7 to 5,144 (0·05 per cent.) in 1945–6, the financial loss has been more than halved, while production has risen from 66 to 91 tropical cases per acre.

Acuña (J.) & De Zayas (F.). **El mosaico y otras plagas de la Fruta Bomba (Carica papaya L.).** [Mosaic and other pests of Papaw (*Carica papaya* L.).]—*Circ. Estac. agron. Cuba* 85, 32 pp., 14 figs., 1946.

The papaw in Cuba suffers from two types of mosaic [*R.A.M.*, xviii, p. 808], of which the more widespread (A) corresponds with bunchy top [ibid., xxvi, p. 114]. The other (B), confined to certain localities in Habana, is known as 'Cotorro mosaic' from the place of its discovery. This form of the disease is much more destructive than (A), causing 100 per cent. infection on a number of Jamaican and Trinidad selections and other varieties. It may be recognized by the circular, greenish spots on the base of the young petioles, and sometimes on the stems, expanding with the growth of the plant to several centimetres in length and up to 1 cm. in width and becoming hook- or U-shaped. In heavily infested areas the fruits may also be spotted, but the lesions do not extend as in the case of the petioles and stem. The abrupt shortening of the internodes and the torsion of the stem

typical of bunchy top have not been observed in the case of 'Cotorro mosaic', while another distinctive feature of the latter is the abundant flow of latex, resulting from punctures in the fruits, which consequently fail to mature and are of insipid flavour. The basal leaves, instead of developing at right angles to the stem, describe an obtuse angle or form clusters, often persisting after the defoliation of the upper part of the tree; in some cases a new tuft of small leaves may be produced higher up the trunk. The flowers drop simultaneously with the leaves, interrupting the setting of the fruits. In affected seedlings, and sometimes even in older plants, only the fibrous tissue of the leaves may develop and the veins, instead of being arranged in pinnate form, run in parallel lines, separated by a conjunctive tissue devoid of chlorophyll. Severely infected young leaves may show necrotic areas suggestive of chemical injury. The virus does not appear to be seed-borne. Some idea of the rapidity of its spread may be gained by observations in 1946 at the Habana Agricultural Experiment Station where the number of diseased trees rose from one in February to 160 at the end of June.

The Orlando, Solo, Florida, and Sabatier varieties are the most susceptible to bunchy top, Colombia, Mamey de Botánica, Castilla, and Mamey being comparatively resistant. The difficulties of breeding for resistance to the viruses are greatly complicated by the extreme susceptibility to Cotorro mosaic of all the varieties tested. Pending further investigations on this aspect of control, fruits intended for seed should be taken exclusively from healthy trees, all diseased plants promptly destroyed, weeds eradicated to avoid the perpetuation of the viruses by carriers, and strict hygienic precautions observed in the plantations.

Scarcely one adult plantation is free from *Pucciniopsis caricae* [loc. cit.], while other fungal diseases include *Gloeosporium* [? *papayae*: loc. cit.], perhaps the most important source of spoilage at harvest-time, *Phyllosticta*, *Rhizoctonia*, *Oidium*, and *Meliola* spp.

Langford (G. S.). **Entoma : a directory of insect and plant pest control. Sixth edition.**—320 pp., published by the Eastern Branch of the American Association of Economic Entomologists, sixth edition, 1945. $1.00. [Received May, 1947.]

This publication, designed to assist plant pathologists and others interested in plant pest control to obtain information of a kind that is sometimes difficult of access, includes articles on insecticides and fungicides, spreaders, penetrants, adhesives, and emulsifiers, diluents, and so forth, as well as a number of useful tables. Alphabetical lists are given of plant protectants and equipment, the names of the suppliers being listed, and of services, agricultural officials, seed analysts, societies, and so forth.

Kearns (H. G. H.). **Disease, pest and weed control equipment for horticultural crops.**—*Occ. Publ. hort. Educ. Ass.* 5, pp. 51–56, 1947.

After referring to the importance of disease and pest control in horticultural practice, the author gives brief notes on the types of equipment at present used.

Recent progress has been mostly in the design of fruit-spraying equipment, the war having made it possible to demonstrate the outstanding advantages of a large-sized, high-efficiency tractor-drawn and -driven outfit, the sprayer with a 300-gal. tank and an output of 20 g.p.m. being the most convenient. Further minor advances may be made by the use of multi-nozzle brooms and in the technique of application, but it is clear that the peak of efficiency of the lance handled by the walking spray operator has been almost reached. If the effort and cost involved in spraying are to be reduced and the speed of application increased, the

problem will have to be approached from a new angle. Either the type of machine must be some form of self-propelled outfit with a man-operated spraying turret or trees will have to be grown to suit a machine with spray bars. With few exceptions, dusting is as yet a poor substitute for spraying and progress with the design of dusting equipment is not worth while attempting until the value of dusting has been properly investigated.

Chester (K. S.). **National requirement and availability of botanists.**—*Amer. J. Bot.*, xxxiv, 4, pp. 240–243, 1947.

From two statistical surveys of personnel requirements in botany and plant pathology, respectively, in the United States, based on replies to questionnaires submitted to a leading botanist in each State and Territory and in the Department of Agriculture, the author concludes that in both fields a minimum deficit of 17 to 20 per cent. of the trained personnel is to be anticipated by 1950 [cf. *R.A.M.*, xxv, p. 512].

Whyte (R. O.). **Crop production and environment.**—372 pp., 12 figs., 32 pl., 41 graphs, 3 maps, London, Faber & Faber, 1946, 25*s*.

This book, in which the author has brought together as much as possible of the recent research on the developmental physiology of plants, particularly crops, is of general interest to the plant pathologist. The chapters on photoperiodism, resistance to adverse environment (including a short reference to the relationship between resistance to fungous diseases and physiological development), and breeding in relation to environmental requirements are of special importance in view of the interchange of plants for breeding between different parts of the world.

Perreault (C.). **Le climat et les maladies des plantes.** [Climate and plant diseases.] —*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 11–16 [? 1947].

In this paper the author discusses the effect of climatic factors on the incidence of plant diseases with particular reference to the conditions obtaining in Quebec Province. To give a few examples: infection of flax by *Fusarium oxysporum* f. *lini* [*F. lini*] does not flourish in soils with a wide temperature range (12° to 38° C.). Onion smut (*Urocystis cepulae*) is present in Montreal, but not in the Lower St. Lawrence area, where the soil temperature is under 10° during May, when sowing is carried out. To avoid wheat infection by *Tilletia levis* [*T. foetida*] (which becomes serious when the soil temperature is between 2° and 7°), the autumn sowings are carried out in the Lower St. Lawrence area in the last fortnight of August, when the figure is about 15°. The effect of soil moisture is shown by the fact that flax even when attacked by *Colletotrichum lini* [*C. linicola*] grows vigorously in a well-drained soil, whereas in one that becomes sodden during the first few weeks after sowing young plants readily become infected. In such cases the virulence of the fungus seems to be enhanced. Reference is also made to the effect of wind and light on the development and spread of various forms of leaf infection. The paper concludes with the suggestion that the number of meteorological observation posts in agricultural areas in Quebec might usefully be increased.

Chapman (G. H.). **The significance of, and methods for, maintaining moisture in bacteriological culture media.**—*J. Bact.*, liii, 4, p. 504, 1947.

The loss of moisture from the surface of agar plates stored in refrigerators can be greatly reduced by enclosing the plates in metal cylinders sold for this purpose and sealing the joint between top and bottom sections, preferably with waterproof adhesive tape, parafilm, or a rubber band. Tubes of culture media can be sealed by covering the plug or screw cap and rim with parafilm.

Groves (J. W.) & Skolko (A. J.). **Notes on seed-borne fungi. II. Alternaria.**—*Canad. J. Res.*, Sect. C, xxii, 5, pp. 217–234, 10 pl., 1944.

In this paper [cf. *R.A.M.*, xxiv, p. 42; xxv, p. 590] the authors describe and figure seven species of *Alternaria* (six of which are pathogenic) isolated from 47 species of agricultural seed received at Ottawa.

A. tenuis was isolated from all the seeds tested, and appears to have a world-wide geographical distribution [ibid., xxvi, p. 51]. *A. brassicae* was isolated from seeds of cabbage, cauliflower, rape, and radish of Canadian, United States, and Dutch origin.

A. dauci (Kühn) n.comb., the cause of an occasionally serious leaf blight of carrots, was found only on two samples of seed from Nova Scotia and Ontario. It is close to *A. brassicae* morphologically but differs from it in its darker spores, the beaks of which are slenderer, more pointed, and more branched, and in its cultural characters and host relationships. The earliest name of the species appears to be that proposed by Kühn, who described it as *Sporidesmium exitiosum* var. *dauci*. Rostrup raised Kühn's variety to specific rank as *Macrosporium dauci*. Neergaard has shown that Rostrup misidentified the fungus and was working with that later described as *A. radicina* [ibid., xv, p. 768]: nevertheless Article 54 applies here, and Rostrup's combination must be considered as based on Kühn's type. There appears to be little doubt that *M. carotae* is the same species.

A. linicola n.sp. [ibid., xxv, p. 581], found on flax seeds from Quebec, Ontario, Manitoba, Saskatchewan, and Alberta, produces effused, cottony, slightly concentrically zoned colonies on malt agar, deep to dark olive-grey, pale at the centre; the septate, branched, hyaline to pale smoky-olive hyphae measure (2) to 4 to 7 μ in diameter, and the pale olive-brown, septate, simple, conidiophores are 5 to 8 μ in diameter, and very variable in length; the obclavate conidia, not found in chains, gradually attenuated above into a long, slender, sometimes branched beak, were olive-brown, smooth, muriform, had 7 to 11 transverse septa, at which they were slightly constricted, and measured (130) to 150 to 300 by (15) to 17 to 24 μ.

A. raphani n.sp. [loc. cit.] forms effused, cottony, zoneless, pale olive-grey to pale gull-grey, occasionally darker to olive- or iron-grey colonies on malt agar. The septate, branched, hyaline to smoky-olive hyphae measure 2 to 5 to (7) μ in diameter. The numerous chlamydospores are olive-brown, at first one-celled, round, finally many-celled and irregular. The olive-brown, septate, simple or sometimes branched conidiophores vary greatly in length, measure 4 to 7 μ in diameter, and are generally larger towards the tip. The conidia are arranged in short chains, obclavate, beaked (the beak usually being short), smooth, olive-brown, muriform, with 3 to 9 transverse and numerous longitudinal septa, at which they are constricted. They measure (40) to 50 to 70 to (94) by 15 to 25 to (45) μ on seedlings on agar in Petri dishes, and (55) to 70 to 115 to (135) by 14 to 18 to (25) μ on inoculated leaves in the greenhouse. The fungus produces black, circular spots up to 4 mm. in diameter on the seed pods of radish [ibid., xxvi, p. 8]. It was isolated from radish seeds originating in Ontario, Quebec, and British Columbia, and those imported from California, Michigan, Minnesota, New Jersey, Ohio, and Pennsylvania. Inoculations in the greenhouse on seedlings of radish, cauliflower, broccoli, swedes, cabbage, and wallflower (*Cheiranthus cheiri*) gave positive results on all but wallflower.

A. radicina was isolated frequently from carrot seed, occasionally from parsley, and once from vegetable marrow.

A. oleracea is of wide geographic distribution and appeared on seeds of swedes, broccoli, cauliflower, cabbage, radish, and runner bean (*Phaseolus coccineus*).

Groves (J. W.) & Skolko (A. J.). **Notes on seed-borne fungi. III. Curvularia.**—*Canad. J. Res.*, Sect. C, xxiii, 3, pp. 94–104, 7 pl., 1945.

Continuing their investigations on seed-borne fungi [see preceding abstract]

the authors made a study of the species of *Curvularia* found during their examination of agricultural seeds. The species observed, which exhibited no marked host specificity and appeared to have no pathological significance, were *C. geniculata* from cabbage, flax, and pea; *C. inaequalis* from turnip, flax, pea, rye, spinach, and maize; and *C. trifolii* from soy bean, pea, cucumber, and pumpkin (all identified by comparison with types); *C. lunata* from onion and chilli pepper; and *C. pallescens* from cauliflower and turnip (both identified provisionally from the literature). *Helminthosporium cymbopogi* [*R.A.M.*, xxi, p. 419] is transferred to *Curvularia* as *C. cymbopogi* n. comb. The authors found that the spore measurements of the type specimens of the four North American species, *C. geniculata*, *C. inaequalis*, *C. trifolii*, and *C. falcata*, failed to agree with the published descriptions of the original authors. A subculture of one of the original isolates of *C. cymbopogi* did, however, produce spores agreeing in size with the measurements given in the diagnosis.

Groves (J. W.). **Variations in Botrytis cinerea.**—Abs. in *Proc. Canad. phytopath. Soc.*, *1946*, 14, p. 13, 1946.

Analysis made in 1938 of 177 single-ascospore cultures from the apothecia of nine different isolates of *Botrytis cinerea* [*Sclerotinia* (or *Botryotinia*) *fuckeliana*: *R.A.M.*, xxv, p. 235] demonstrated that 18 produced only white mycelium, without conidia or sclerotia, 17 gave abundant macroconidia and no sclerotia, while 142 were intermediate and showed some sclerotia and macroconidia. Many of the cultures were discarded, but of the others three originally of the white mycelial type and two of the conidial remained as at first described. Fifty-nine of the original intermediate type remain, of which ten are now like the white mycelial type, two resemble the conidial type, and the others are still intermediate. According to the dual-phenomenon hypothesis [see next abstract] the mycelial types might be regarded as M types, the conidial as C types, and the others as MC types. Since, however, all these came from single ascospores and there was no possibility that heterocaryosis was a factor, the validity of this hypothesis as an explanation of variation in *S. fuckeliana* would appear to be doubtful.

Miller (J. J.). **The theories concerning variability in fungi.**—Abs. in *Proc. Canad. phytopath. Soc.*, *1946*, 14, p. 13, 1946.

Hansen's 'dual phenomenon' theory [*R.A.M.*, xxii, p. 490] assumes that variants arise through the segregating out of genetically different nuclei from multinucleate mycelia. This fails to account for the appearance of variants in the progeny of uninucleate, haploid conidia, which must be attributed to mutation. 'Adaptive variation' results from the appearance of adapted types through mutation.

Hawes (Ina L.) & Eisenberg (Rose). **Bibliography on aviation and economic entomology.**—*Bibliogr. Bull. U.S. Dep. Agric.* 8, iv+186 pp., 1947.

This work, comprising very short abstracts of 1,084 publications and 32 pages of index, is a revision and enlargement of the Bibliography on the Use of Airplanes in Insect Control, 1922 to 1933, compiled by W. E. McBath in 1934. It covers the years 1919 to 1944 and includes some 1,945 references. Three of the entries deal with fungi.

Moore (W. C.). **New and interesting plant diseases.**—*Trans. Brit. mycol. Soc.*, xxix, 4, pp. 250–258, 3 pl., 1946.

This is another contribution to the author's series of notes on plant diseases in Britain [cf. *R.A.M.*, xxv, p. 568]. In 1945, and again in 1946, he received garden specimens of corn salad (*Valerianella* [*locusta* var.] *olitoria*) from the vicinity of Bodmin, Cornwall, bearing *Oidium valerianellae*, with long-elliptic, oblong, or barrel-shaped conidia, 27 to 39 by 13 to 21 μ.

In September, 1941, a leaf spot causing partial or complete defoliation of elder was observed in a beech wood near Harpenden. The spots were numerous, visible on both sides of the leaves, mostly 2 to 5 mm. across, rounded, or bounded by the secondary veins, uniformly dull grey when small, and later becoming bleached dirty white or pale brown, usually with a dull grey border. The conidia of *Cercospora depazeoides* occurring on both sides measured 50 to 147 by 4 to 6 (average of 25, 89 by 4·9 μ), one to six transverse septa were present. The disease was later reported from three other localities.

In Britain, black rot (*Sclerotinia tuberosa*) [ibid., ix, p. 134] attacks the native *Anemone nemorosa*, but has been found in the past mainly in gardens and rockeries on cultivated varieties of *A. nemorosa*, as well as on *A. coronaria*, *A. apennina*, *A. blanda*, and *A. ranunculoides*. It may be destructive to pot plants, but seldom occurs in commercial plantations. In the only recorded outbreak in Britain in recent years (May, 1933), very large numbers of apothecia appeared in a rock-garden near Birmingham, where few of the anemones remained unaffected. In October, 1941, the author received from Buckinghamshire rhizomes of *A. nemorosa* var. *robinsoniana* completely destroyed by the fungus during storage. The sclerotia were black, irregular, round, hard bodies up to $1\frac{1}{4}$ in. across and almost $\frac{1}{2}$ in. thick; they were white inside, and consisted of a mass of interlacing hyphae 4 to 6 μ wide surrounded by a narrow, black rind 15 to 40 μ thick.

Cos lettuce plants of the Balloon variety raised under glass and pricked out for summer use in two adjacent gardens at Harpenden in mid-July, 1942, developed a disease later found to be due to the dandelion yellow mosaic virus [ibid., xxv, p. 492]. Several plants, evidently attacked when quite young, were only 6 in. instead of a foot tall. The outer four or five leaves were small, but in other respects appeared to be normal. The next inner leaves were small and narrow, crimped or puckered, and displayed a conspicuous general necrosis; this began as minute, somewhat angular, pale brown, interveinal dots later coalescing to form patterns of dark brown, grey-brown, or almost black tissue immediately bordering the veins in the middle of the leaves. The margins of some leaves were wilting or withered, and in others the tips and sometimes the margins for $\frac{1}{2}$ cm. inwards presented a burnt appearance. Affected plants with outer leaves still green, turgid, and a foot long showed different symptoms, the next inner leaves being pale, and partly withered from the tips or margins inwards. The tissues were brown, dry, and papery, or the interveinal areas had dropped out. The veins usually showed brown or black streaking. Other plants bore a few scattered, inconspicuous, pale brown areas on the outer mature leaves, while the next inner ones showed only a local or diffuse and ill-defined necrosis, the chief symptom being a ladder-like brown fretting of the outer, and occasionally of the inner, surface of the main and lateral veins. The youngest leaves seldom showed more than a faint necrosis. This lettuce disease has very probably been present in England for some time.

Since its discovery on Dutch lettuces imported into England in 1930, *Puccinia opizii* has twice been observed in this country, on both occasions on lettuces imported from Holland. It was found in the London market in 1932 [ibid., xiii, p. 10], and in May, 1946, a few aecidia were seen on the outer leaves of lettuces in four of ten crates examined on the quayside at Newcastle-on-Tyne. The aecidia have a complete and well-developed peridium, form fairly large spots, and cause no hypertrophy of the leaf tissues. The aecidium found on lettuce in North America appears to be different, and for this Kern accepted the name *P. patruelis* Arthur.

Radish canker, observed only a few times in Britain, was first recognized on specimens from Taplow in 1928, when *Corticium solani* [cf. ibid., xiii, p. 725; xiv, p. 340] was isolated in pure culture. In June, 1935, the disease was reported to have developed in patches on two farm crops, one on sandy soil at Mortlake (Surrey), the other on heavier soil at Bedfont (Middlesex). Specimens from Mortlake showed

dark, soft, canker-like lesions on the sides or near the top of the swollen portion of the root, and no difficulty was experienced in isolating *C. solani* from the advancing margin of the rot where there was abundant mycelium. Healthy radishes inoculated with a pure culture of the organism developed the rot after only a day or two, the disease progressing so rapidly that within a fortnight only the discoloured skin and part of the vascular network remained intact as in naturally infected radishes. It was estimated that at Mortlake not more than one plant per thousand was affected, but this was sufficient to spoil the appearance of the bunches. At Taplow the disease occurred every year, but caused no serious trouble. Preliminary tests indicated that strains of *C. solani* from potato would not infect radish. The radish strain failed to infect carrots, parsnips, mangolds, and potatoes inoculated late in July, but white turnips and radishes inoculated the same day were completely rotted by mid-August. These results were later confirmed and extended by Storey [ibid., xx, p. 591].

In June, 1942, the author examined diseased flax seedlings about 6 in. high, from Hampshire, the cotyledons of which were brown and fell off at a touch. Most of the affected cotyledons were blackened as a result of the presence of tufts of conidiophores and conidia of a species of *Alternaria* identified as *A. linicola* Groves & Skolko [see above, p. 405]. Some seedlings showed minute, dark spots on the first pair of foliage leaves above the cotyledons. The spots spread irregularly to produce necrotic areas 1 to 2 mm. across, and on a few seedlings this pair of leaves was completely discoloured and shrivelled. There was also an occasional pale brown streak on the stem just above the cotyledons, and more frequently a scarcely perceptible, shallow, canker-like area on the hypocotyl or at the base of the main root. The rim of the canker was reddish-brown, and reddish-brown streaks passed from it upwards into the hypocotyl. The conidia measured 60 to 235 by 11 to 27 with a beak 15 to 135 μ, and showed 4 to 11 transverse septa.

Ledingham (G. A.). **Methods of preservation of fungus cultures.**—Abs. in *Proc. Canad. phytopath. Soc., 1946*, 14, p. 15, 1946.

In the 'lyophile' method of preservation, found satisfactory for most small-spored fungi, yeasts, and bacteria, a heavy spore suspension is made in a sterile 12 per cent. aqueous solution of difco skim-milk powder, and using a sterile Pasteur pipette 1 c.c. aliquots are transferred to sterile pyrex ampoules. The ampoules are then 'quick-frozen' in an acetone dry ice bath and transferred to a chilled vacuum desiccator, which is evacuated overnight. The tubes are next evacuated on a manifold and sealed by cutting off with a hand torch with a cross-fire attachment. The dried culture then consists of a small water-soluble milk pellet sealed in glass under vacuum. Many species remain viable for years in these conditions.

Jenkins (Anna E.) & Bitancourt (A. A.). **Spot anthracnoses in the United States and some island possessions.**—*Plant Dis. Reptr*, xxxi, 3, pp. 114–117, 1 map, 1947. [Mimeographed.]

A distribution map and key list is given of 23 spot anthracnoses [*R.A.M.*, xxvi, p. 255] recorded in the United States, Puerto Rico, Guam, and Hawaii up to 1942. The list includes common name of the disease, Latin binomial and family of the host, and the pathogen relating to each anthracnose. The distribution of the 23 anthracnoses reported is based on records available in June, 1946.

Jehle (R. A.), Walker (E. A.), Preston (D. A.), & Jenkins (Anna E.). **Additional records on distribution of Plantain scab.**—*Plant Dis. Reptr*, xxxi, 4, pp. 162–166, 2 maps, 1947. [Mimeographed.]

In Maryland, plantain scab (*Sphaceloma plantaginis*) is abundant on *Plantago rugelii*. More specimens were found in small towns than in open fields in the

country, which suggests that man is an important agent in spreading the disease. New records extend the known distribution of the disease to Oklahoma and Minnesota. On several occasions isolated groups of narrow-leaved plantain (*P. lanceolata*) were found with leaf spots resembling plantain scab. Microscopic examination showed that they were caused by *Cercospora plantaginis*, a fungus not previously reported in Maryland.

Sibilia (C.). **La nomenclatura volgare in patologia vegetale. Proposte per una nomenclatura ufficiale.** [Common names in plant pathology. Proposals for an official nomenclature.]—*Nuovo G. bot. ital.*, N.S., lii, 1–4, pp. 87–91, 1945. [Received July, 1947.]

After mentioning the confusion that exists in Italy among the common names applied to plant diseases, several different names being applied in some instances to one and the same disease or one name serving for diseases caused by several different organisms, and also discussing, with illustrative examples, the difficulty of finding satisfactory Italian equivalents for foreign common names, particularly English names of virus diseases, the author refers to the work of the Plant Pathology Committee of the British Mycological Society in compiling a list of suitable common names in English [*R.A.M.*, xxiv, p. 425], and suggests that a committee should be established in Italy to perform a similar task for Italian workers. Official lists of common Italian names should give the common name of the host, the systematic group of the pathogen, the common name recommended, the Latin name of the pathogen, common Italian names used but not recommended, and, finally, the foreign common names. The principles that should guide the committee in the selection of the most suitable names are listed.

Christensen (C. M.). **Molds and bacteria in flour and their significance to the baking industry.**—*Bak. Dig.*, xxi, 1, pp. 21–23, 2 figs., 1947.

During the past two years the writer has examined over 100 flour samples from mills in different parts of the United States for their mould and bacterial contents. In general, the mould incidence ranged from less than 200 to more than 5,000 per gm., being higher in flour milled in the more humid regions. About 20 species of moulds have been determined, with *Aspergillus glaucus* and *A. candidus* predominating [*R.A.M.*, xxvi, p. 239], while a large population of green *Penicillium* was found in occasional lots. It would appear from the evidence so far accumulated that flour may be excluded as a general source of bread spoilage, the relatively few organisms present being in any case destroyed by baking.

Milner (M.) & Geddes (W. F.). **Grain storage studies. IV. Biological and chemical factors involved in the spontaneous heating of Soybeans.**—*Cereal Chem.*, xxiii, 5, pp. 449–470, 6 graphs, 1946.

Spontaneous heating and associated respiratory characteristics of soy-beans at humidity levels conducive to mould growth [*R.A.M.*, xxv, p. 517] but not to bacterial proliferation were studied in an apparatus maintaining continuously controlled adiabatic and aeration conditions over periods of up to 37 days [ibid., xxi, p. 43]. An initial temperature rise to between 50° and 55° C. and parallel respiratory increase were directly associated with the multiplication of *Aspergillus glaucus* and *A. flavus*. A secondary spontaneous heating phase due to non-biological oxidation was demonstrated. Surface sterilization of the seeds failed to eliminate mould infection, but inoculation of autoclaved soy-beans with *A. flavus* spores resulted in heating and respiration curves virtually identical with those of the original sample.

ETTLINGER (L.). **Antibiose und antibiotische Stoffe der Pflanzen.** [Antibiosis and antibiotic substances of plants.]—*Schweiz. Z. Path. Bakt.*, ix, 5, pp. 352–378, 1946.

This is a discussion, illustrated by numerous examples from the relevant literature, of the information available to date concerning antibiosis, under the aspects of reciprocal antagonism between macro-organisms, macro-organisms against micro-organisms and vice versa, and reciprocal between micro-organisms; and antibiotics, defined according to current standards of terminology as (1) biogenic substances produced by living cells; (2) organic compounds of some complexity; and (3) germ toxins detrimental or lethal, in low concentrations, to the vital functions of micro-organisms, especially pathogens. A four-page bibliography is appended.

BOSE (S. R.). **Hereditary (seed-borne) symbiosis in Casuarina equisetifolia Forst.**—*Nature, Lond.*, clix, 4041, pp. 512–514, 1 fig., 1947.

Every *Casuarina equisetifolia* plant examined by the author (including plants from different parts of India and also from Australia) had mycelia of *Phomopsis casuarinae* in every organ, beginning with the seed-coat. The results of experiments with seedlings of *C. equisetifolia* in humus soil with a pure culture of *P. casuarinae* as well as of others made to lower the physiological condition of pot plants by keeping them in a glass chamber for two weeks confirmed the view that the physiological condition of the host determines the nature of the relationship between the two partners in a mycorrhizal association [*R.A.M.*, xxiii, p. 352]. Very weak seedlings in a moribund condition and pot plants in an abnormal state were killed outright by the fungus, which became strongly virulent, while slightly weak but normal seedlings were greatly invigorated by the fungal inoculation. It appears that the fungus begins as a symbiont, but ultimately induces the death of the plant or of some of its parts, as a parasite, after which it persists as a saprophyte and is succeeded by *Ganoderma lucidum*, *Fomes senex*, *F. durissimus*, *F. fastuosus*, *Polyporus calcuttensis*, and other fungi as members of a fungal complex.

In addition to *Phomopsis casuarinae*, *C. equisetifolia* also bears coralloid roots or nodules due to *Rhizobium casuarina* Dowson. The roots also possess root hairs at their growing ends. The fungus probably absorbs ammonia salts and complex organic nitrogen compounds such as nucleic acid and peptone and transfers them to the roots; it is probable that auxins and vitamins accumulated by the hyphae are translocated to the roots, while the molecular nitrogen fixed by bacteria (amino acid) is probably made available throughout the body of the plant. In return, the fungus obtains carbohydrates from the tree and phosphatides from the roots. This is regarded as a clear example of close co-operation between the plant, the fungus, and the bacterium for successful and healthy growth of the tree. Details of this work are expected to be published later.

BLUMER (S.). **Beiträge zur Physiologie von Trichoderma viride Pers. ex Fries.** [Contributions to the physiology of *Trichoderma viride* Pers. ex Fries.]—*Ber. schweiz. bot. Ges.*, liv, pp. 605–624, 3 graphs, 1944. [Received July, 1947.]

Trichoderma viride, one of the most active cellulose decomposing soil fungi [*R.A.M.*, xvi, p. 408], grows in synthetic nutrient solutions with cellulose as a source of carbon. When nitrogen is supplied in the form of nitrates, aneurin [vitamin B_1] and pyrimidine exert a slight stimulatory action on the growth of the organism, whereas thiazole is devoid of influence. When ammonium salts are the source of nitrogen (especially ammonium citrate), the slight initial stimulus afforded by vitamin B_1 and pyrimidine gives place later to a definite inhibition.

Lilly (V. G.) & Barnett (H. L.). **The influence of pH and certain growth factors on mycelial growth and perithecial formation by Sordaria fimicola.**—*Amer. J. Bot.*, xxxiv, 3, pp. 131–138, 4 graphs, 1947.

The rate and extent of growth of *Sordaria fimicola* in the presence of a sufficiency of biotin is a function of the composition and initial pH of the medium. Normal development and reproduction are suppressed in the pH range of 3·4 to 3·8, the inhibitory factor, however, being counteracted by the addition of thiamin or its pyrimidine moiety [cf. *R.A.M.*, xix, p. 723]. Perithecia were produced only after the pH had risen above 6 and an adequate quantity of biotin was provided: the number of these organs depended on the concentration of the growth factor and is estimated to have been at least a hundredfold greater at the maximum of 0·16 μg. per flask than at 0·0025 or 0·005. Less biotin was required for vegetative growth than for sexual reproduction.

From a preliminary comparison of five isolates of the fungus it appeared that all need an exogenous supply of biotin, supplemented in one case by thiamin.

Barnett (H. L.) & Lilly (V. G.). **The effects of biotin upon the formation and development of perithecia, asci and ascospores by Sordaria fimicola Ces. and de Not.**—*Amer. J. Bot.*, xxxiv, 4, pp. 196–204, 8 figs., 1947.

On a biotin-free medium *Sordaria fimicola* produced no perithecia in two months [see preceding abstract]. The addition of the growth substance at a range of 0·1 to 6·4 μgm. per l. after 42 days' incubation resulted in the development of these organs and in ascospore formation in proportion to the amount supplied. Perithecia were also formed by *S. fimicola* on a biotin-free substratum in the presence of certain species known to synthesize the vitamin, e.g., *Phycomyces blakesleeanus*, *Monascus purpureus*, and *Aspergillus rugulosus*. When the biotin supply was held constant at 0·1 μgm. and the provision of nutrients varied, mature perithecia and ascospores appeared more rapidly and in relatively larger numbers in those cultures where mycelial growth was limited by the meagre quantities of food. The available evidence indicates that the amount of biotin in the medium in proportion to mycelial weight at the time of perithecial formation must equal or exceed a ratio of approximately 1: 20,000,000 for the accomplishment of sexual reproduction by *S. fimicola*.

Leach (J. G.) & Bishop (C. F.). **Purple-top wilt (blue stem) of Potatoes.**—*Bull. W. Va agric. Exp. Sta.* 326, 35 pp., 1 col. pl., 12 figs., 3 graphs, 1 diag., 1946.

In this paper the authors review the present state of knowledge on purple-top wilt or blue-stem disease of potatoes [caused by the aster yellows virus: *R.A.M.*, xxv, p. 335] and describe the results of studies carried out on the disease in West Virginia since 1939. It appears to be most abundant in the northern and eastern regions of the United States [ibid., xxiv, p. 284], the range of greatest prevalence being from New York State westward to Minnesota and North Dakota and southward through the mountainous areas of Pennsylvania and West Virginia. It is reported as not being of any importance in the southern States or in the Far West.

Photographs and more complete descriptions obtained by correspondence clearly identify 'moron' disease [ibid., xii, p. 188] with purple top. Diseases with which purple-top wilt has been or may be confused include *Rhizoctonia* [*Corticium solani*] stem rot, certain types of blackleg infection [*Erwinia phytophthora*], some forms of mechanical injury, a wilt attributed to *Fusarium avenaceum* [ibid., xvii, p. 409], 'hay wire' [ibid., xvi, p. 490], purple dwarf [ibid., xx, p. 319], and 'stem-end browning' [ibid., xxvi, p. 119]. In diagnosing the disease points of primary importance are: (1) it is not tuber-transmitted and is never found on young plants, the first symptoms appearing at or after blossoming; (2) the plants always wilt

two or three weeks after the symptoms appear; (3) there is always necrosis of the vascular elements at the base of the stem, often spreading to the stem end of the tubers; (4) translocation is inhibited and carbohydrates accumulate in the tops. The remaining symptoms, including the purple pigmentation and production of aerial tubers, may vary with the potato variety, light intensity, temperature, and many other factors.

Evidence obtained in West Virginia since 1939 has confirmed the conclusion that the disease is caused by the aster yellows virus and is transmitted by *Macrosteles divisus*. Every year from 1939 to 1943, inclusive, 40 to 60 aster-cloth or screen-wire cages enclosing four to six potato plants were used for field inoculation experiments with aster leafhoppers and certain other insects. No plant became affected unless aster leafhoppers were introduced, the disease then appearing in 18·9 per cent. of 290 cages. Some of these leafhoppers were not known to be viruliferous, but when all viruliferous hoppers were used the figure was 40·8 per cent. in 98 cages. On the other hand, all attempts to transmit the virus from potatoes to asters failed. The virus could not be recovered from naturally infected potatoes or transmitted from potatoes to potatoes. Many attempts to perpetuate the virus by making cuttings from infected potatoes all gave negative results, the disease evidently affecting the physiology of the plant in such a way that normal graft unions and cuttings can be obtained only with great difficulty, if at all. The evidence demonstrated that the virus does not long survive in the potato plant.

It was found that the incubation period in potatoes (34 to 68, average 49, days in cage experiments) is longer than in asters and some other plants. Field infection probably occurs after 11th June and before 9th July. No evidence could be found that 'hair sprout' [ibid., xvii, p. 700] is a result of purple-top wilt. Comparative yield tests indicated that plants affected with purple-top wilt gave, on an average, yields of rather less than one-half of those from healthy plants. The minimum daily temperature appeared to be the principal factor controlling leafhopper movement. There was little movement, and few hoppers were caught when the minimum temperature was 60° F. or below. There were two periods of heavy flight each summer, but some moderately heavy ones always occurred in May and early June, and these appear to be responsible for the infection of potatoes.

As there is no evidence that aster leafhoppers breed on potatoes and the virus does not spread from potato to potato, infection on this host must arise from migratory adult leafhoppers.

No satisfactory control method has yet been devised, but there is some evidence that dusting or spraying the plants with DDT reduces infection.

Discussing seed-certification practices in relation to the disease, the authors express the view that if purple-wilt tolerance limits are established they should be based on the behaviour of the affected plants as weak plants rather than as plants affected with an infectious virus disease. Tubers from affected plants produce weaker plants than tubers from healthy ones and the yield is reduced on the average by about 24 per cent. Tolerances, if established, should be liberal, and flexible enough to allow for differences in date of inspection. Roguing should be permitted in order to meet the tolerances, and field inspections should be as late as possible.

List (G. M.). **Some relationships of insects to net necrosis of the Potato in Colorado.** —*J. econ. Ent.*, xl, 1, pp. 107–112, 1 graph, 1947.

Potato net necrosis [usually attributed to potato leaf roll+potato virus A] is prevalent in Colorado in some seasons, especially in garden patches and small acreages. The symptoms closely resemble those of psyllid yellows induced by *Paratrioza cockerelli*, to which, in fact, the disease has been referred [cf. *R.A.M.*, xxvi, p. 119]. However, greenhouse and field tests yielded no evidence in support of this view. A careful analysis of the data from exposed plots and those protected

by aster-cloth fences from the six-spotted leafhopper, *Macrosteles divisus*, indicated that the exclusion of the insect prevents both the infection of asters by the aster yellows virus [ibid., xxvi, pp. 120, 208, and proceeding abstract] and of potatoes by that of net necrosis. Heavy psyllid infestation in a plot protected in this way did not result in an outbreak of net necrosis, which appears, on the basis of these experiments, to be in all probability attributable to the aster yellows virus.

MATTHEWS (R. E. F.). **Status of Potato virus B.**—*Nature, Lond.*, clix, 4047, pp. 713–714, 1947.

From a serological comparison of Up-to-Date potato streak virus [a strain of potato virus X: *R.A.M.*, xxii, p. 76], supplied by Clinch, with virus B [another strain of potato virus X: ibid., xvi, p. 53] from Bawden's source in Duke of York it was concluded that the latter has an antigenic portion which differs from the streak virus in Up-to-Date. The reverse is also probably true, though the possibility that part or all of this difference may be caused by an X-type strain present together with the streak strain in Clinch's material has not been eliminated.

The suggestion is made that virus B is no more a single entity than is virus X. Many strains of X may, perhaps, be found which do not give top necrosis on varieties such as Epicure and King Edward. This conclusion, together with the results obtained by Bawden and Sheffield [ibid., xxiii, p. 403], indicates that no sound basis exists for giving the strains known as 'virus B' any special status within the X Group.

CLINCH (PHYLLIS E. M.) & MCKAY (R.). **Effect of mild strains of virus X on the yield of Up-to-Date Potato.**—*Sci. Proc. R. Dublin Soc.*, N.S., xxiv, 21, pp. 189–198, 1947.

Two Up-to-Date potato plants free from virus X having been found in Ireland in 1943, an experiment was begun to ascertain to what extent X-free plants of this variety would outyield carrier plants [cf. *R.A.M.*, xxiii, p. 144; xxiv, pp. 162, 335].

It was deemed necessary that infected plants should be obtained by using infected tubers. To obtain this stock of infected tubers two large X-free Up-to-Date tubers, clonal progeny of the original plants, were selected, each being cut into three sets, the six sets being planted in pots in an insect-proof glasshouse. One plant of each clone remained as a healthy control, while the remaining two were grafted with scions of Up-to-Date carrying mild strains of virus X. The two strains of the virus used, both of which occur naturally in Up-to-Date, were (*a*) a typical mild strain, identified as the potato 'mottle' virus of North America [ibid., xiv, p. 523], and (*b*) formerly known as 'Up-to-Date streak' and later as virus B [see preceding abstract].

In 1945, the produce of the six units was grown in a small isolated plot among beans in a freshly ploughed pasture field. In July, the plants were tested by inoculation into *Datura stramonium*, and it was found that virus X was present only in the plants grafted with infected scions the previous year. With clone I the average yields per plant for the healthy plants and those infected with strains (*a*) and (*b*) were, respectively 4 lb. 1 oz., 4 lb. 1 oz., and 5 lb. 4 oz., the corresponding figures for clone II being 5 lb. 5 oz., 5 lb. 7 oz., and 5 lb. 15 oz.

In 1946 the tubers of each healthy clone were graded according to weight and selections for planting were made from them in such a way that an equal number of tubers of similar weight was available from the infected units of the clone corresponding. Up to the middle of June no difference was detected between the healthy and infected plants. About the middle of June, however, some of the plants of clone II infected with strain (*b*) developed leaf roll, but no more developed for the remainder of the season, nor was there any difference in appearance between

the healthy and X-infected plants generally. Inoculation tests with *D. stramonium* demonstrated that all the originally healthy plants were still X-free. Blight (*Phytophthora infestans*) developed towards the end of August in spite of spraying with Burgundy mixture, and killed off the plants prematurely. The average yield of tubers per X-free plant was 3 lb. 8 oz. Plants infected with strain (*a*), clone I, yielded 3 per cent. less than the healthy, while those of clone II gave 4 per cent. more. Plants infected with strain (*b*), clone I, outyielded the healthy by 13 per cent., while those of clone II gave 14 per cent. less. This reduction, however, was clearly due to primary leaf roll, and apart from this last figure, the results in general indicate that no significant reduction in yield was caused by the latent strains of virus X used, the tendency being rather towards an increase in yield as a result of infection.

Baribeau (B.) & Gagnon (R.). **L'indexage des Pommes de terre de semence.** [Tuber-indexing of seed Potatoes.]—Reprinted from *Agriculture*, [? *Quebec*], iii, 2, 15 pp., 8 figs., 1 diag., 1946.

In this paper the authors give a full account in popular terms of the tuber-indexing method for the control of potato mosaic, leaf roll, and other virus diseases [*R.A.M.*, xiv, p. 714; xvii, p. 615], together with brief details of the use made of the method in Quebec in recent years. In 1938–9, 584 seed-potato tubers were indexed and mosaic in the resultant crops averaged 14·9 per cent. The following season 29,381 tubers were indexed and mosaic averaged 6·4 and leaf roll 0·5 per cent. In 1944–5, 27,028 tubers were indexed and mosaic and leaf roll averaged 3·1 and 2·6 per cent. respectively. Each year about 70 per cent. of the indexed tubers are derived from seed not indexed the year before. If such had not been the case, the percentage of virus disease that developed would have been reduced by over two-thirds. In the spring of each year, the indexed, healthy tubers are returned to the producer who plants them in plots, using the isolated tuber method. During the summer, each unit in every plot is carefully inspected two or three times, and all diseased and doubtful units are destroyed. The results show that in 1943, 33 per cent. of the plots were placed in the 'foundation' category (seed potatoes being placed in three categories with respect of amount of disease tolerated: 'foundation', 'foundation A', and 'certified'), the figures for the next two years being 60 and 75 per cent. respectively. The total production of potatoes from indexed tubers was expected to exceed 3,000 minots [1 minot = 39 l.] in 1945.

Details are given of an official scheme by which indexed tubers are to be multiplied by the establishment of centres of production of certified seed of the 'foundation' category.

[A shorter version of this paper appears in *Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 29–37, 7 figs., ? 1947.]

Généreux (H.). **Désinfection du sol dans le but de lutter contre la gale commune des Pommes de terre.** [Soil disinfection with a view to controlling common scab of Potatoes.]—*Rep. Quebec Soc. Prot. Pl., 1943–1944*, pp. 89–93, [? 1947].

In Quebec, potato scab [*Actinomyces scabies*: *R.A.M.*, xxv, p. 521; xxvi, p. 77] is a serious problem in the plain of Montreal, particularly in the vicinity of the Ile-Jésus and Napierville. In 1934, 1935, and 1936, a survey of 15 fields in this locality showed, respectively, 92·3, 88, and 93 per cent. affected tubers. It was also found that (1) tubers dug before 20th August showed very little infection, (2) soils with pH under 5·5 invariably gave only slight infection, (3) soils containing free lime favour the disease, (4) the use of fresh horse dung increases severity, (5) well-drained fields showed more scab than poorly drained, (6) grey soils showed more disease than yellow ones and yellow more than black, (7) scab was more serious in light than in heavy soils, and (8) the percentage of tubers affected varied little

during the three years but the degree of infection on the individual tubers varied greatly, such variations bearing no relation to temperature.

Soil-disinfection experiments were conducted near Montreal from 1937 to 1942 inclusive in 44 fields, the chief treatments applied being yellow mercuric oxide ($2\frac{1}{2}$, 5, and 10 lb. per acre), calomel [mercurous chloride] (5 to 10 lb.), and sulphur (750 lb.). These materials were applied to the rows by hand just before planting. The average yields (saleable potatoes with not more than 1 per cent. scab in minots per acre [1 minot = 39 l.]) for the years 1937 to 1939 were, untreated control 81·2; mercuric oxide+celite [ibid., xviii, p. 728] 5 lb., 118·1; mercurous chloride+celite 5 lb., 120·1; mercurous chloride 10 lb.+celite, 130·3; mercurous chloride 10 lb.+fertilizer, 130·9; and sulphur 750 lb., 108·8; while for 1940, 1941, and 1942 together, the figures were, control, 81·4; mercuric oxide $2\frac{1}{2}$ lb.+celite, 88·2; mercuric oxide 5 lb.+celite, 89·7; mercuric oxide 5 lb.+fertilizer, 87·2; mercurous chloride 5 lb.+fertilizer, 83·7; mercuric oxide 10 lb.+fertilizer, 78·1; and sulphur 750 lb., 92·9.

These results show that on the whole soil disinfection proved satisfactory during the first three years and less so during the second three. In some soils the mercury compounds favoured infection; sulphur gave promising results, but sometimes reduced yields.

Laboratory tests demonstrated that mercury compounds become reduced in soils to metallic mercury [ibid., xxiv, p. 199] which passes through the soil by diffusion in a volatile form; hence, any factor impeding the reduction of mercury compounds would arrest the action of the mercury [ibid., xxv, p. 361].

In further experiments over two years, eight strongly alkaline soils treated with 5 lb. mercurous chloride per acre and the same+sulphur [quantity unspecified] averaged, respectively, 1·79 and 1·11 per cent. scab, as against 5·5 per cent. for the untreated control. This result indicates that acidity-promoting conditions to some extent reduce scab in the presence of mercury compounds.

ROGER (L.). **Les champignons à sclérotes parasites du Riz.** [Sclerotial fungi parasitic on Rice.]—*Bull. écon. Indochine*, vi, 1–5, 302 pp., 14 pl., 17 graphs, 1942. [Received April, 1947.]

In this work the author presents the results of a series of very detailed investigations carried out from 1938 to 1941 in Cochin-China on the group of rice diseases known as 'tiem' or 'weakening' and associated with a number of fungi, all of which form sclerotia. The first part (pp. 1–38) outlines the problem and the methods pursued and lists the fungi studied, the second (pp. 39–255) gives a detailed account of the organisms concerned treated systematically, and the third (pp. 256–296) deals with specific determinations, studies of comparative pathogenicity, and control methods.

'Tiem', initiated by unfavourable environmental and biological conditions resulting from defective irrigation, is associated with *Corticium rolfsii* [*R.A.M.*, xvi, p. 405], *C. centrifugum* [loc. cit.], *C. solani* [ibid., xx, p. 423], *Hypochnus* [*C.*] *sasakii* [ibid., xviii, p. 617], *Leptosphaeria salvinii* (and its mycelial state *Sclerotium oryzae sativae*) [ibid., xix, p. 615; xxiv, p. 247], *S. oryzae* var. *irregulare* n.var., *S. fumigatum* [ibid., xiv, p. 652], *S. delphinii* [ibid., xiii, p. 387 *et passim*], *S. hydrophilum*, *S. coffeicola* [ibid., xix, p. 326], *S. japonicum*, *Rhizoctonia microsclerotia* [ibid., xix, p. 301], *R. oryzae* [ibid., xx, p. 423], *R. zeae*, and *R. destruens*. Of these, *S. delphinii*, *S. coffeicola*, *R. zeae*, and *R. destruens* become parasitic on rice only accidentally, while *S. japonicum* becomes so on experimental inoculation.

S. oryzae sensu lato comprises two distinct groups of fungi. One contains *Leptosphaeria salvinii*, stat. conid. *Helminthosporium sigmoideum* Cav. [ibid., xi, p. 469; xiv, p. 119], and stat. mycel. *S. oryzae* 'type'. *H. sigmoideum* var. *microsphaerioides* Nakata is considered synonymous with *H. sigmoideum*. The second

group consists of *H. sigmoideum* var. *irregulare* [ibid., xv, p. 47], which is synonymous with *H. sigmoideum* Nakata (non Cav.), and its sterile form *S. oryzae* var. *irregulare*, synonyms of which are *S. microsphaerioides* Nakata, *S. oryzae* (Park's 'A' strain) [ibid., xv, p. 114], and *Sclerotium* Sakurai no. 3 [ibid., xv, p. 49]; the perfect state has not been found.

C. sasakii is synonymous with *S. irregulare* Miyake. *R. microsclerotia* Matz is synonymous with *Sclerotium* Sakurai no. 2 [loc. cit.] and very probably with *S. sphaerioides* Nakata; it is identical with Park's 'B' strain of *R.* [*Corticium*] *solani* [ibid., xv, p. 114] (confirmed by Matz) and Mundkur's non-chromogenic 'A' strain of *S. oryzae* [ibid., xv, p. 313]. Some writers assimilate *S. sakurai* no. 2 with *S. sphaerioides* and make them into a group rather different from the *R. microsclerotia* type. Park's 'A' strain of *C. solani* probably belongs to that species. According to Whetzel *C. centrifugum* is synonymous with *C. rolfsii*; while Bertus considers that *R. destruens* is also the same as *C. rolfsii*. *R. zeae* is close to *R. oryzae*.

Keys are given for identifying the mycelial forms by means of their cultural characters, colorimetric reactions, and sclerotial size and anatomy.

A full, detailed study is presented of the cultural, morphological, anatomical, physiological, and biological characters of the more important of these organisms, somewhat briefer treatment being accorded to *S. delphinii*, *S. hydrophilum*, *S. coffeicola*, and *S. japanicum*, which are all of minor importance. Under local conditions, the most virulent were ascertained to be *L. salvinii*, *C. rolfsii*, and *C. solani*. The only feasible method of controlling 'tiem' is to improve drainage, all other methods being only palliatives. Burning infected haulms after harvest is recommended. The practice of flooding the rice fields between two crops is useless and should be abandoned. The soil should, however, be kept damp but well aerated. One of the three following methods, depending on the local conditions, should be adopted: (1) maintain a low, constant soil humidity between two harvests; (2) maintain humidity for two months, then allow as long a drying period as possible; (3) after maintaining humidity for two months, allow complete and prolonged flooding. Rotation, where possible, would help. The ideal method would be to avoid stagnant water by instituting hydraulic arrangements which would permit water to be let in or out at any time desired. Planting methods should be such that the critical phases of vegetation never coincide with unfavourable climatic conditions (15th August to 15th September, locally). In some cases it would be advantageous to grow early varieties. In the nurseries the plants are too thickly sown. Once infection has taken place the water should be run off completely and not used again. Irrigation should then be repeated with clear water several times. The effects of these measures are, of course, not lasting, and they must be re-applied continually.

Honig (P.), Vollema (J. S.), & Kortleven (J.). **Selectie van Hevea.** [*Hevea* selection.]—*Chron. Natur.*, ciii, 5, pp. 63–67, 1947. [English summary.]

Particulars are given of the methods and results of the systematic selection of *Hevea* rubber for resistance to South American leaf blight (*Dothidella* [*Melanopsammopsis*] *ulei*) [*R.A.M.*, xxvi, pp. 29, 334, 417], now in progress at the Paramaribo Agricultural Experiment Station, Surinam, under the guidance of Professor G. Stahel in co-operation with the United States Department of Agriculture. Very promising material for breeding has been developed from *H. viridis*, indigenous in the region extending from Rio Negro to the Cassiquiare, Brazil, while two other species from eastern Brazil, *H. paludosa* and *H. minor*, are also to be included in the investigation.

M. ulei, hitherto regarded as an obligate parasite, is stated to have been grown in pure culture on malt agar supplemented by a decoction of young rubber leaves boiled for 30 minutes at the rate of 50 gm. per l.